Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

AUGUST, 1960

CONTENTS:

Read and pass on—

1500 KW SILICON POWER INSTALLED at COOPER-BESSEMER PLANT*

The Cooper-Bessemer Corp.'s Grove City, Pa., Plant has recently installed three 500 KW RAPID ELECTRIC Silicon rectifiers which are now supplying heavy cranes, machine tools, ventilators and pumps with d-c power.

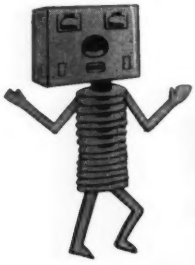
Cooper-Bessemer's selection of Silicon was based on its advantageous (inherent) high voltage characteristics and resulting high efficiency and power factor.

Specially designed protective systems, together with Silicon's natural longevity will insure continuous operation for many years (See insert).

For further information on this installation or other silicon installations and applications write or call, Shop Materials Company**, 733 Washington Road, Pittsburgh 28, Pennsylvania.

*Machinery Builders, (Engines and Compressors.)

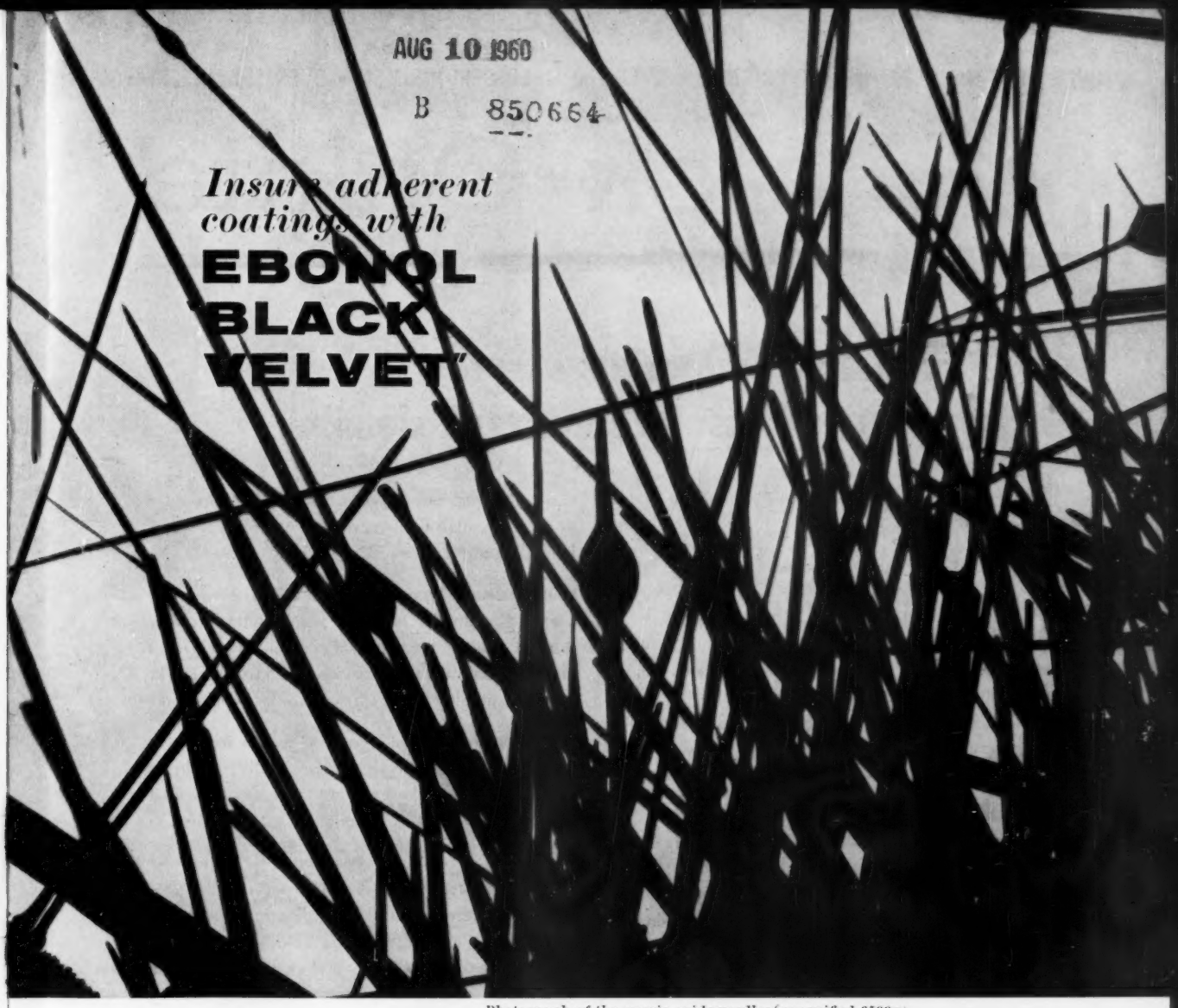
**Representing RAPID ELECTRIC in the State of Pennsylvania.



RAPID ELECTRIC COMPANY

2881 Middletown Road • New York 61, N. Y. • TAlmadge 8-2200

Plants: (4) New York, New York • Grays Bridge Road, Brookfield, Conn.



Insure adherent coatings with

EBONOL "BLACK VELVET"

Photograph of the cupric oxide needles (magnified 6500x) produced by immersion of copper part in hot solution of Ebonol "C" Special.

Treating copper and brass surfaces with Ebonol "C" Special will insure high adhesion for almost every type of coating. This patented product of Enthonics Research forms thousands of jet black cupric oxide needles per square inch. Once these needles become imbedded in the coat or adhesive, and the coating sets, adhesion is tight and long-lasting. Lacquers, enamels and plastics are all bonded firmly to copper or brass surfaces when these surfaces have been pre-treated with Ebonol "C" Special.

Use Ebonol "C" coatings to achieve extremely low reflectivity on military equipment and optical parts. The coatings absorb oil, giving better lubrication of copper surfaces. They resist corrosion and produce an attractive finish with little dimensional change. Heat radiating and absorbing abilities of the surface are increased. Printed circuit manufacturers oxidize copper foil in Ebonol "C" Special before coating with adhesive and bonding to the plastic laminate. Result: double the bond strength.

Write for the complete story on Ebonol "C." We promise it will be immediately rewarding.
Enthone, Incorporated, 442 Elm Street, New Haven, Connecticut.

ASARCO

ENTHONE

A subsidiary of American Smelting and Refining Company

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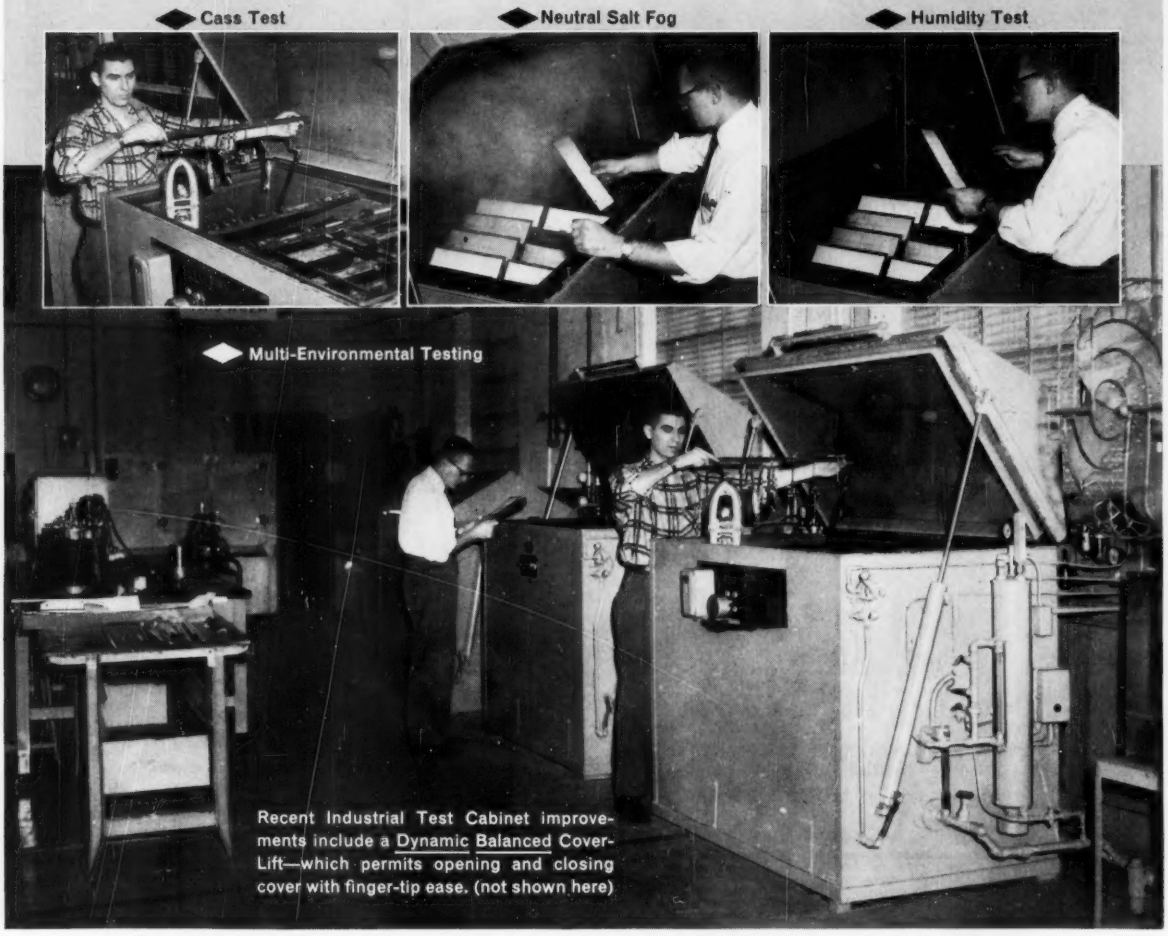
American Motors Fights Corrosion with INDUSTRIAL Test Cabinets



Rigid accelerated corrosion tests show reliability of Type 411 Cabinets

Corrosion resistance comes under conscientious control at American Motors. Typical of their emphasis on serviceability and long life for the RAMBLER product is their attention to the environmental testing of plated and painted parts.

Among recent test equipment additions to their production test facility at Kenosha, Wisconsin, were three of our new Type 411 Corrosion Test Cabinets. Particularly suitable for this auto manufacturer's needs, Type 411 is versatile enough to meet all the essential requirements for neutral salt fog, humidity and "Cass" corrosion tests.

The vulcanized, rubber-lined cabinet is of double wall construction to provide uniform temperature within the test area. All saturation and heating processes are under positive control. Relative humidities of 95 to 100% from ambient temperatures to 125° are routine.

Close cooperation with government and the military; ASTM, AES, and conformity to most federal and commercial requirements, specifications and procedures have placed the new INDUSTRIAL Type 411 Test Cabinets in demand . . . *wherever* environmental simulation and accelerated corrosion tests serve improved quality control standards.

SEND FOR NEW LITERATURE

CP-160

INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. CO.

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PRESSURE FILTERS ♦ ION EXCHANGERS ♦ CORROSION TEST CABINETS ♦ PUMPS ♦ WATER & WASTE-TREATING EQUIPMENT

No Bright Nickel ever offered more

THE UNIVERSALLY APPROVED

HARSHAW NUBRITE

BRIGHT NICKEL PROCESS

Only Harshaw Nubrite meets all of the following qualifications:

1. *Most experienced* bright nickel process. The Harshaw Nubrite Bright Nickel process has given outstanding results to platers for many years.

2. Accepted as superior—*throughout the world.* Harshaw service is available to users throughout the world with distribution or manufacturing facilities in England, Holland, Australia, and Canada.

3. Operates *successfully* with either *air or mechanical agitation.* Recent improvements permit operation with *either* air or mechanical agitation, depending on *your requirements.*

4. Fast brightness—without sacrificing leveling, ductility, or *outstanding economy.*

5. Addition agents (*all liquid*) stocked throughout the world. Ease of operation is aided by the use of all liquid addition agents in easy to handle containers.

Join the growing number of satisfied users by contacting your nearest Harshaw Branch or write for informative free booklet: Harshaw Nickel Plating Processes.

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Plating Processes also available through the following Foreign Distributors or Manufacturers:

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Armalite Co. Ltd., Toronto, Canada
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And many Agents throughout the world

New Heavy Duty Convertible

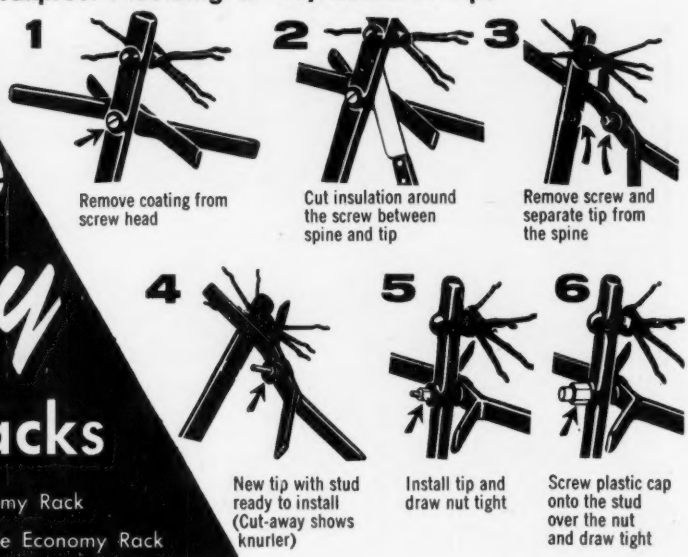
from fixed tip to replaceable tip

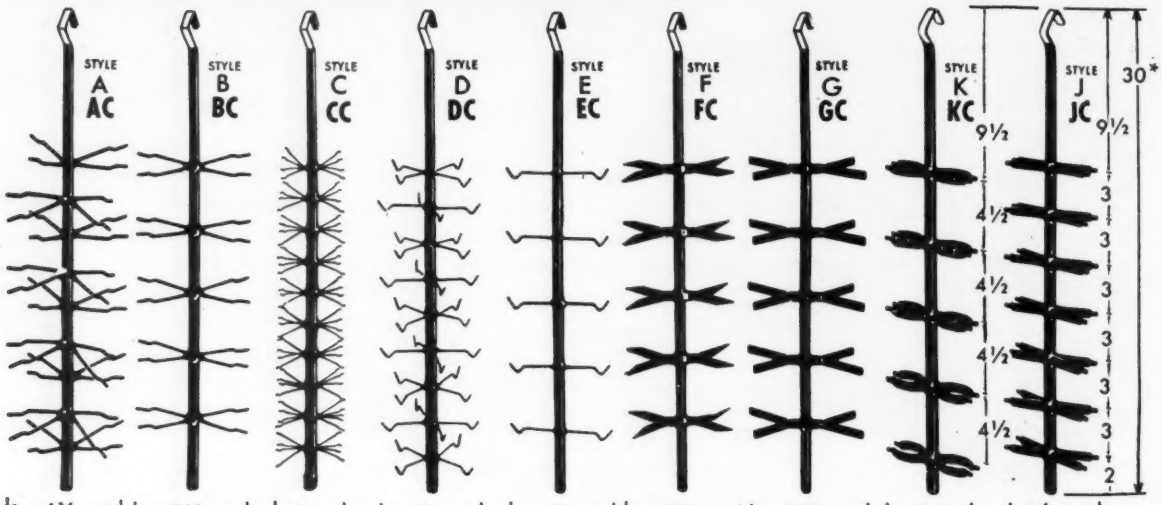
Economy Plating Racks

One letter designates Non-convertible Economy Rack

Suffix "C" designates Heavy Duty Convertible Economy Rack

Leakproof Mounting of Replacement Tips





①A $5.78	B $4.77	C $6.00	D $5.83	E $4.42	F $5.84	G $5.69	K $5.75	J $6.50
②AC 6.95	BC 5.77	CC 7.35	DC 6.95	EC 5.20	FC 6.95	GC 6.95	KC 6.95	JC 7.85

①Cat. No. and Prices of Non-Convertible Economy Racks.

②Cat. No. and Prices of New, Heavy Duty, Convertible Economy Racks.

*36 inch lengths also available.

All prices F. O. B. Chicago, subject to change without notice.

Add $1.50 packing charge on orders for less than 12 racks.

No variations at these prices except in mass production quantities.

Developed in response to widespread demand for Economy Racks that could be kept at 100% capacity through endless years of use. These NEW Convertible Economy racks have special rivited tip assembly that is easily removed for replacement with pre-insulated, self-sealing THINKER BOY Tips.

The Convertible Economy Rack Spines are 25% heavier. Quality construction—mass production economies make possible the low prices.

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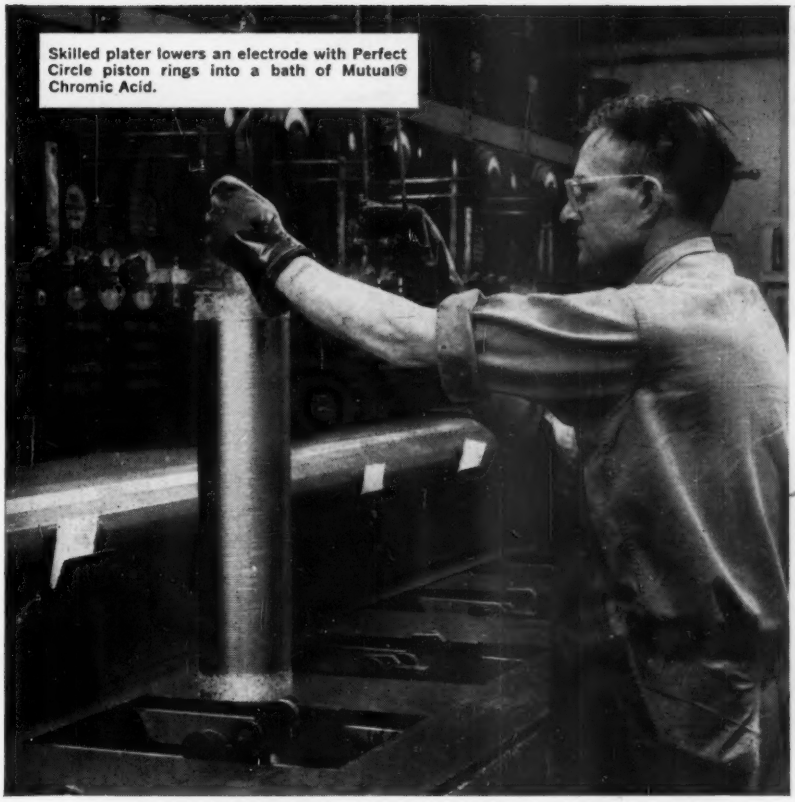
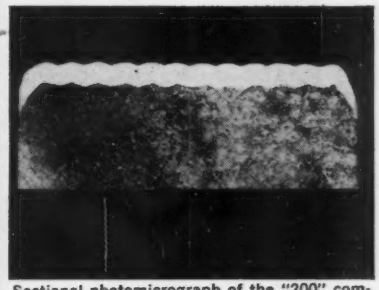
947 N. Cicero Ave., Chicago 51, Ill.

EVERYTHING FOR PLATING PLANTS



Skilled plater lowers an electrode with Perfect Circle piston rings into a bath of Mutual® Chromic Acid.

Photo shows the Perfect Circle "200" chrome top compression ring (L) and "98" self expanding oil ring (R). The face of the compression ring and the steel rails of the oil ring are plated with solid chrome .004"-007" thick.



Sectional photomicrograph of the "200" compression ring shows interrupted surface and thick plating of chrome.

FOR PRECISION CHROME PLATING PERFECT CIRCLE USES MUTUAL CHROMIC ACID

Perfection is the goal in producing piston rings. Each is machine tooled to exacting specifications and the chrome plating must be flawless. To safeguard against plating difficulties . . . and expensive rejects . . . Perfect Circle Corporation relies on Mutual Chromic Acid. Like many experienced platers, Perfect Circle knows that careful control, plating skill plus Mutual Chromic Acid add up to a top quality chrome finish.

Mutual Chromic Acid is always 99.75% pure—or better. Sulfate content never exceeds 0.1%. Rigid quality control by Mutual insures that the chromic acid you get is always the same. This makes it easier for you to control accurately the acid-sulfate ratio of your plating bath.

To obtain further information about these and other advantages of Mutual Chromic Acid, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service Staff will also be happy to offer help or information at any time.

OTHER PRODUCTS FOR PLATERS

SOLVAY® Ammonium Bicarbonate ■ SOLVAY Caustic Soda
SOLVAY Hydrogen Peroxide ■ SOLVAY Methylene Chloride

Allied Chemical

SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

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☐ Send Bulletin 52, "Chromium Chemicals"
☐ Have a representative phone for appointment

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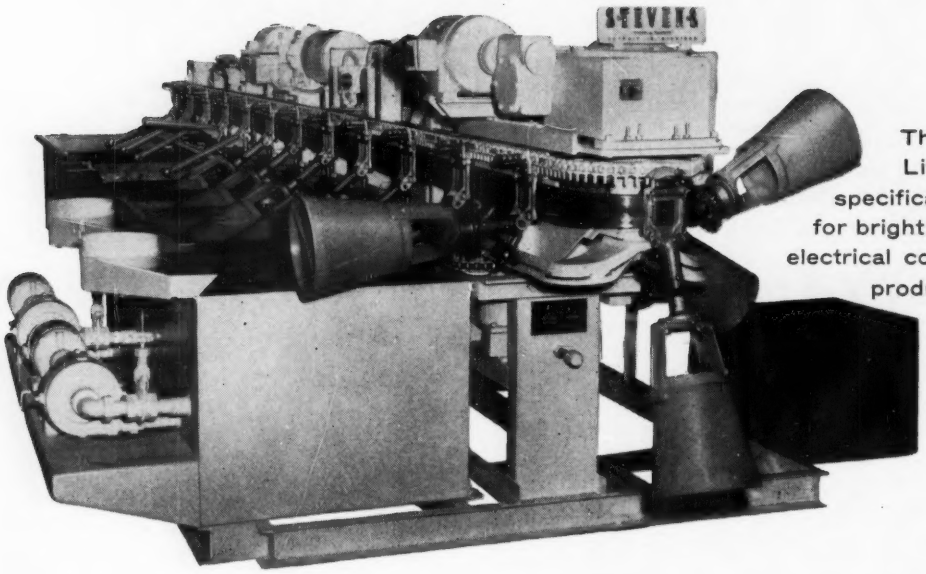
H-VW-M
SUPERLUME
THE PREMIUM BRIGHT NICKEL BATH

we admit it...there may be other baths as bright as H-VW-M Superlume

but



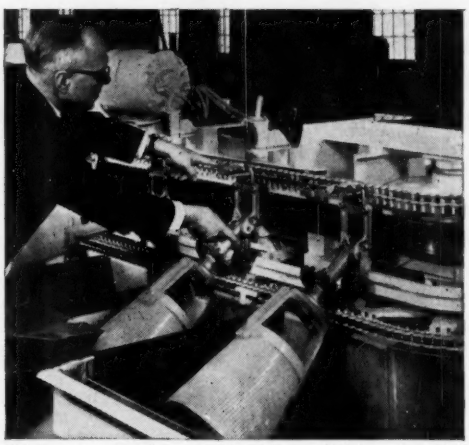
This particular Little Steve is specifically designed for bright dipping tiny electrical components at production speed.

NEW LITTLE STEVE BARREL MACHINE REVOLUTIONIZES PRECISION PLATING AND PROCESSING OF SMALL PARTS

Completely automatic, extremely compact, mechanically flexible, inexpensive to buy, install, maintain.

Meet the newest member of the famous Little Steve family of automatic plating and processing machines. It is small . . . only 4 feet high by 6 feet wide . . . not much higher or wider than your desk. Designed for use in your integrated operations, it incorporates features that meet today's rigid manufacturers' specifications. For example, this new Little Steve provides: • **precision plating on an automatic basis • low ceiling height and light floor load • designed for integrated process manufacturing • oblique barrels that require no lids • automatic loading and unloading • minimum solution and anode requirements.**

PLUS many more of the exclusive features that are part of every dependable, long-lasting, efficient Stevens plating and processing machine.



This exclusive selective 'skip track' feature permits elimination or addition of any processing step. Note 'no lid' barrels, easy accessibility of mechanism to operator standing on the floor.

Write today for complete information on this processing profit-builder.

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BUFFALO CHICAGO DETROIT CLEVELAND
DAYTON NEW HAVEN INDIANAPOLIS SPRINGFIELD (OHIO)

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For Any Degree of Treatment!

And for Chemical and Water Recovery or Pollution Abatement!

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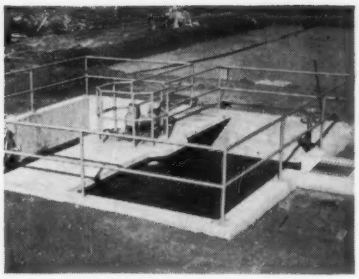
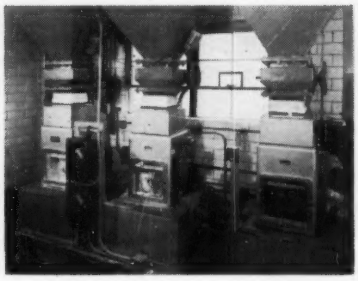
Has the Equipment!



VORTI® Mixers

1. Low Power Consumption due to efficient rotor design.
2. Trouble-free operation with no under water bearings.
3. Adapted for rapid mixing, or flocculation.
4. Can be installed in round, square, or rectangular basins.

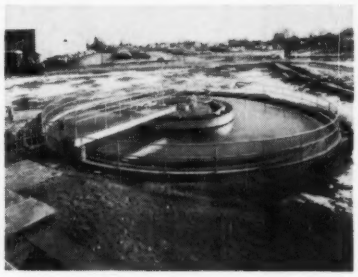
Bulletin 700



Chemical Feeders

A complete line for solution, slurry, dry feed, and lime slaking. Adaptable for constant rate operations or proportioning by flow or pH control.

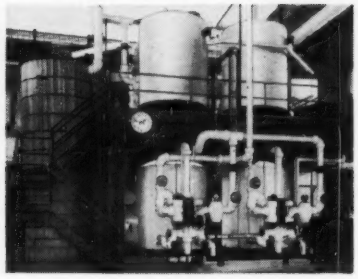
Request Information



CYCLATOR® Clarifier

For clarification and precipitation of toxic metals. Controlled slurry recirculation results in better treatment at higher flow rates. Custom designed skimmers available when needed.

Bulletin 850



CATEXER® ANEXER®
Ion Exchangers

recover chemicals and rinse water in many cases. For chromic acid purification and many recovery applications. Each problem is evaluated to determine the economics of recovery operations with the equipment custom engineered for each application.

Bulletin 1960

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INFILCO will help you and your engineers evaluate any metal finishing waste disposal problem

Let us help you find the *best* way to meet your particular needs—the one combination of equipment for most economical results. Write for Bulletin 80 to acquaint you with the complete line of INFILCO equipment—for every type of water and waste treatment problem.

THE ONLY COMPANY impartially offering equipment for ALL types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

whatever your finishing problem

ACME has—or will design—a machine to solve it

Buffing automobile ventwindow frames with Acme machines sets a new production record for one manufacturer—300% more than the previous high! Faster than ever before, and automatically, Acme buffing machines remove "orange peel" and pits, and give the steel frames a flawless high-luster finish for plating. ■ This is the kind of efficiency that cost-conscious companies, large and small, expect from Acme finishing machines. Basic machine designs achieved over 50 years give Acme customers an advantage of selecting one of many equipment arrangements, even for specialized finishing applications. ■ Automotive trim, building hardware, electrical and plumbing fixtures, appliance bodies and trim, primary metal sheets and coils—it's impossible to list here all the mass-produced parts and products now served by Acme machines. Fact is, Acme has—or will build—custom machines to solve deburring, polishing, and buffing problems in all industries, including yours. Call or write for comprehensive catalog today.

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You get your best buy with
H-VW-M ECON-O-SHAPE NICKEL ANODES

Designed to Save You Money. New H-VW-M Nickel Anodes retain efficient elliptical shape, but are made thicker to give you more weight per inch . . . 1.32 lbs. Standard anode bags fit . . . less scrap loss per anode too. Result: longer runs that save labor.

Pre-Cleaned, Ready for Use . . . H-VW-M Nickel Anodes are detergent-washed, reach you free of chips and grease . . . wrapped in waterproof, greaseproof paper. And H-VW-M supplies titanium hooks as well as monel.

For more information, write today to:

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Alert Supply Company is H-VW-M in the West • Los Angeles • San Francisco

H-VW-M
Progress in metalfinishing through advanced processes • equipment

Cycleflex

FULLY AUTOMATIC
PLATER & ANODIZER

Conveyor Breakdowns Eliminated with new electro-mechanical control and safety device. Racks can't be pushed into sides of tank; load can't drop if power fails during work transfers.

Positive 6-Point Connections. Self-cleaning heavy duty contacts need little or no attention.

Rack Carriers Quickly Removed. A big time saver when servicing, or manually plating large pieces.

Fast Cycle Changes by shifting tank partitions and moving pick-up heads.

No Extra Headroom Required. All elevating mechanism operates below top of rack carrier.

Automatic Loading And Unloading of racks.

Delayed Set-Down to operate automatically with cycle. Furnished if required for conversion coatings and bright dips.

If More Than One Cycle is necessary, by-passing can be built in.

Hydraulic operation, standard.
Pneumatic operation, optional.

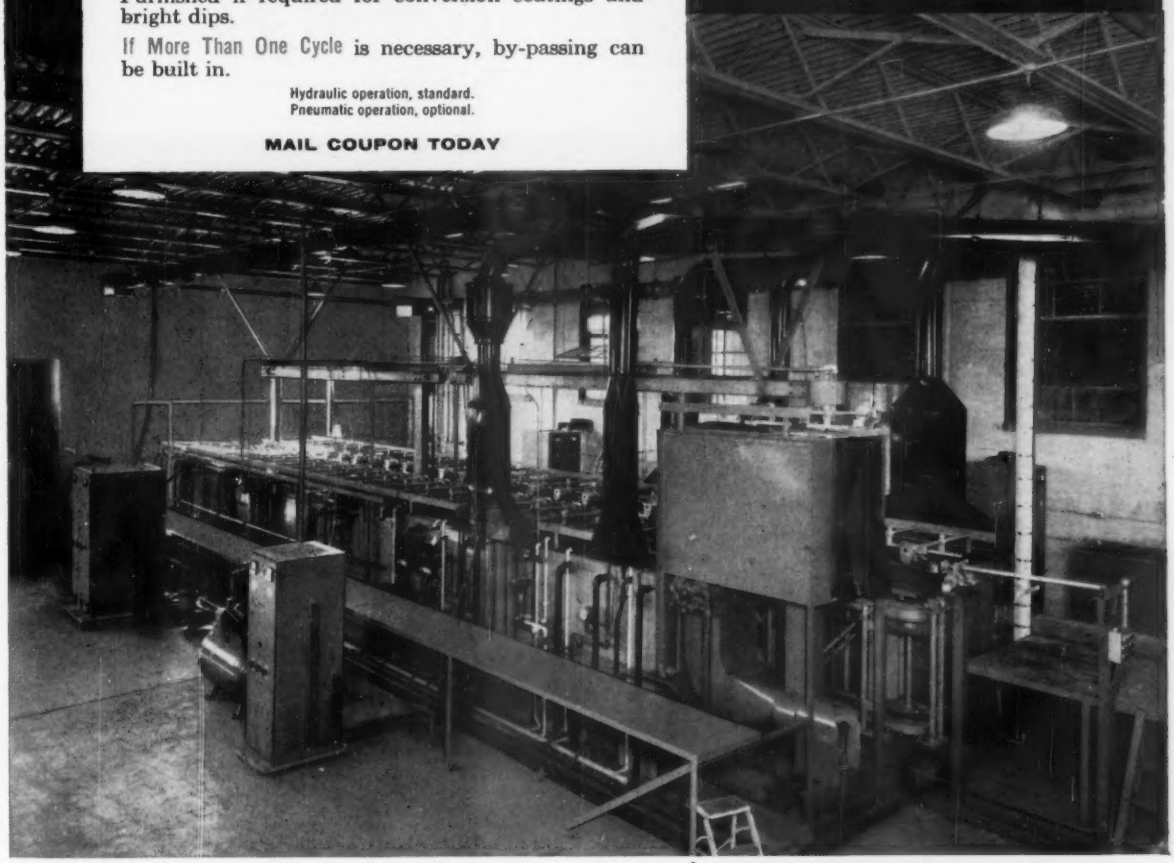
MAIL COUPON TODAY

ONE MAN

handles complete operation of this

MOST VERSATILE

OF ALL AUTOMATICS



LASALCO, INC.

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ATTACH TO COMPANY LETTERHEAD

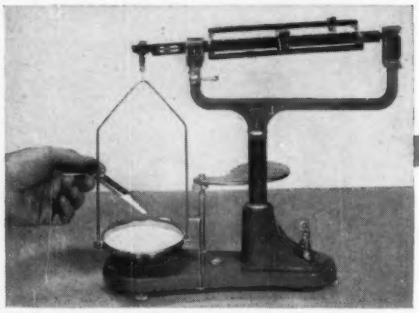
Send complete information on fully automatic Cycleflex

Name.....

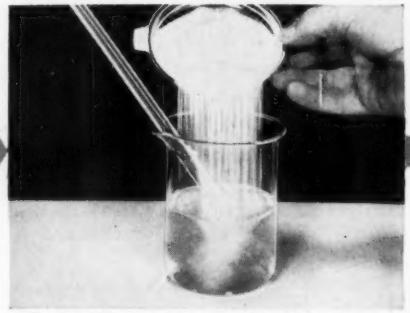
Title.....

Here's how you can save time, re and mixing errors with either o

New "Direct-Route" Method



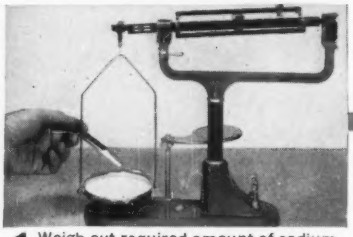
1 Just weigh required amount of sodium-copper or potassium-copper double salt.



2 Dissolve the desired double salt in water or plating solution.

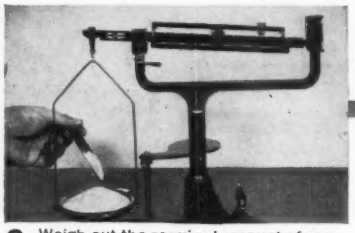
Laboratory demonstration shows how "direct-route" method saves time

Old "Indirect" Method



1 Weigh out required amount of sodium or potassium cyanide.

2 Dissolve the sodium or potassium cyanide in water.



3 Weigh out the required amount of copper cyanide.

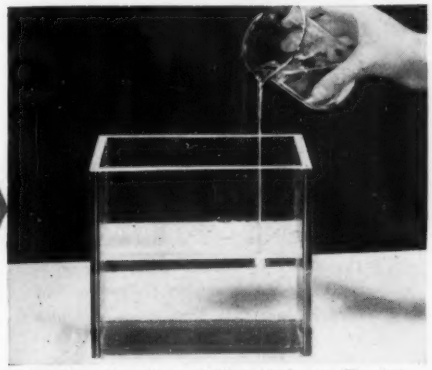
4 Add copper cyanide to water and make a slurry.

5 Dissolve the copper cyanide slurry in solution of sodium or potassium cyanide.

CALL DU PONT FOR ANY ONE OF THESE QUALITY PLATING PRODUCTS. You're assured of superior quality, dependable supply and expert technical service with plating chemicals from Du Pont... your reliable domestic source.

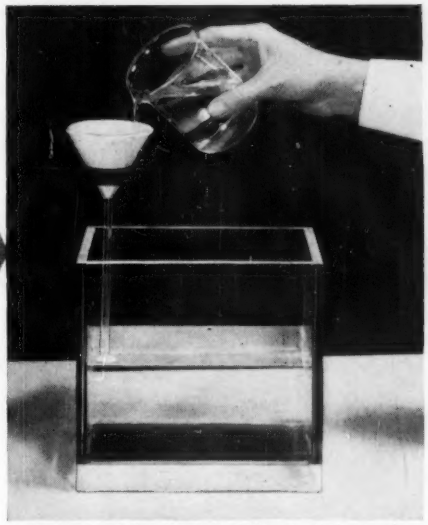
- **Sodium-Copper Cyanide Double Salt**
- **Potassium-Copper Cyanide Double Salt**
- **Copper Cyanide**
- **Potassium Cyanide**
- **All-purpose Cyanobrik® sodium cyanide (in briquette form)**
- **Cyanogran® M sodium cyanide (in granular form)**

e, reduce handling, avoid waste
er of Du Pont's Double Salts...



3 Add directly to plating tank—no filtering necessary.

...avoids errors.



6 Add solution through a filter to plating tank.

SODIUM-COPPER CYANIDE
OR
POTASSIUM-COPPER CYANIDE

SAVE TIME AND REDUCE HANDLING...By using one Du Pont copper cyanide double salt instead of two separate chemicals, you eliminate several steps usually required to dissolve copper cyanide. Just weigh out the Du Pont double salt and dissolve it in water or plating solution. A "direct-route" process! (Compare old and new methods at left.)

AVOID WASTE AND MIXING ERRORS...because active ingredients are in the proportions usually required. This simplifies making and replenishing bath . . . prevents waste resulting from undissolved copper cyanide.

INCREASE CONVENIENCE AND SAFETY...With just one salt to dissolve you minimize handling steps. This means greater convenience—more safety.

Du Pont sodium-copper cyanide double salt and potassium-copper cyanide double salt are white, crystalline and readily soluble. They are made from ingredients of highest quality and purity —Du Pont copper cyanide, sodium cyanide and potassium cyanide.

SIMPLIFY CALCULATIONS...Balanced composition of Du Pont double salts makes it easy to determine amounts required for make-up or replenishment. (1 oz. potassium-copper cyanide double salt is equivalent to 0.26 oz. copper, or 0.37 oz. copper cyanide; 1 oz. sodium-copper cyanide double salt is equivalent to 0.29 oz. copper or 0.41 oz. copper cyanide.)

SODIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	28.7% min.	29%
"Free" sodium cyanide	0.4 to 2.0%	1%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	0.01%

POTASSIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	25.8%	26.3%
"Free" potassium cyanide	1.25% to 3.0%	2.9%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	Trace

Both potassium and sodium double salts are shipped in convenient moisture-resistant 100-lb.-net fiber containers.

For further information or Technical Service call your Du Pont distributor or your nearest Du Pont office, listed at left.

ELECTROCHEMICALS DEPARTMENT • SODIUM PRODUCTS DIVISION
E. I. DU PONT DE NEMOURS & CO. (INC.), WILMINGTON 98, DELAWARE

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REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

DETREX 910

DOES IT WITH BOTH BARRELS

Here's a brand new approach to iron phosphate coating.

Detrex 910 chemically cleans and phosphate coats in one operation. It is designed for use in continuous mechanical spray washing equipment ranging from a 2 to a 6 stage operation.

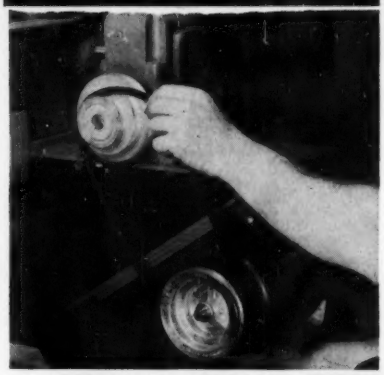
ARE YOU IN A HARD WATER AREA? This field tested and fully guaranteed product is so compounded that it will accept at least fifteen times more alkali than other products and still remain in the PH coating range to produce superior iron phosphate coating. This unique alkali tolerance permits Detrex paint-bond 910 to be used in practically all areas of the United States without special PH control.

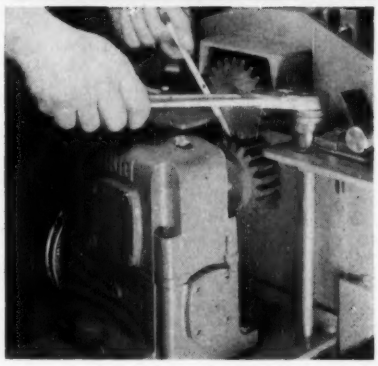
It's a "double-barreled" advancement that can mean important savings to you. Our field engineers will be glad to furnish the details.

DETREX CHEMICAL INDUSTRIES, INC.

P.O. Box 501, Dept. MF-860, Detroit 32, Mich.

G-S
Multiple Station Systems Feature-Packed for Greater Savings!





Fits Platers' Existing Installations
Offers High Performance at Lower Costs

What to do when your present system lets you down: Convert to G-S; the only equipment that permits you to replace as you need it, unit-by-unit, to fit your existing installations of any make, age or model. This 7-station unit is adapted to an original system of different make, thus avoiding high-cost of total obsolescence. Partial conversion brings plant up to highest modern standards. G-S replacement equipment is loaded with exclusive features—plant-proven for better, faster plating; lowest maintenance.

Famous G-S "firsts": G-S "Cogged-V-Belt" Drive—The original "Belt-Drive with the Gear-Grip" (U. S. Pat. 2,562,084); Floating Contacts—no arcing; Adjustable Bearings; Floating Hubs with Locking U's direct danglers downward; Heavier Dangler Cables for higher current carrying capacity; Rugged, All-Welded or All-Bolted Cylinders — and many more.

Inquire about replacement equipment for your installations (to fit any make). G-S "Cogged-V-Belt" Drive Cylinder-Superstructures to fit all tanks. G-S "Cogged-V-Belt" Drive Barrels with tanks. Also, tanks, liners, hoods, motor drives, chute loaders, etc. Send for bulletins and prices today.

(Top) G-S 7-Station Zinc System with 6 G-S "Cogged-V-Belt" Drive Barrels.

(Inset, top) G-S 3-Speed Drive Unit slides easily into channels on tank.

(Middle) Simple belt adjustment on pulleys for any one of 3 speeds.

(Bottom) G-S Single Screw-Adjustable Motor Mount maintains proper gear meshing at all times.

The G-S Equipment Co.

15583 Brookpark Rd. CLearwater 2-4770 Cleveland 35, Ohio

Double-Layer Nickel Plating... bright, new way to give a product lasting sales appeal

Long will her trim stay bright and shiny! For under that mirror-like top coat of chrome on the 1960 Dodge there's a double layer of Nickel Plating.

The first is a heavy layer of semi-bright Nickel – to provide a leveling base, a smooth metal foundation. The second is a fully bright layer to provide the lustrous base needed for a gleaming chrome finish.

It's the double layer of Nickel that actually makes possible the lasting brilliance of the finish. You see, double-layer Nickel Plating works two ways: It acts as a *cushion* against nicks, scratches and abrasions. What's more, it *shields* the basis metal against rust and corrosion.

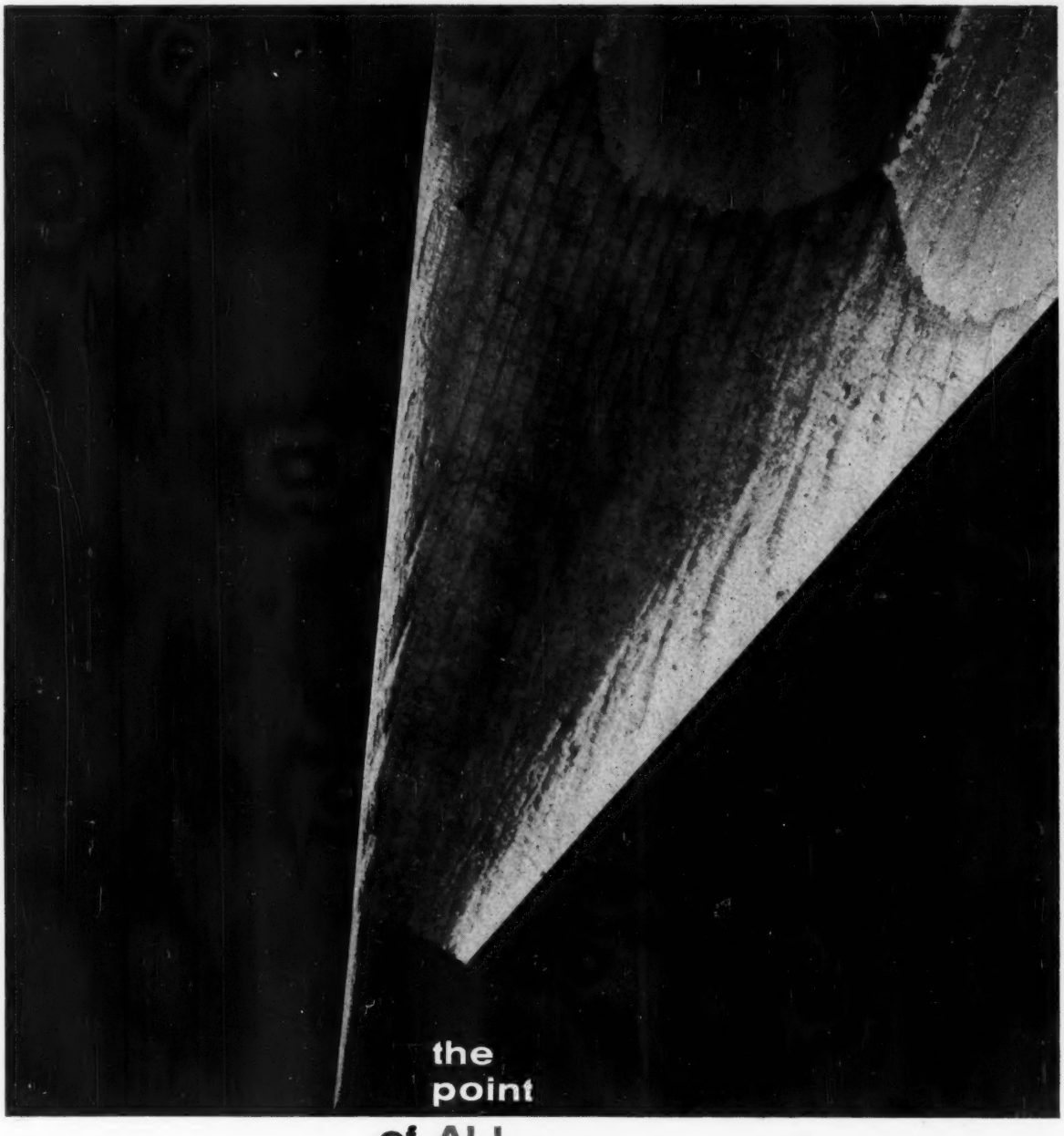
It's truly "The Finish of Lasting Beauty." So rich and lustrous, it's bound to earn an appreciative nod from the prospective buyer . . . so durable and practical, it keeps untarnished a manufacturer's reputation for quality.

With Nickel in ample supply, now is the time for you to look into the advantages of double-layer Nickel Plating. Plan to recommend and use this quality finish whenever a durable and attractive finish is needed.

For information on corrosion testing of plated coatings and how it can help assure the quality of Nickel-Chrome finishes, write for our booklet, "Corrosion Testing of Electrodeposited Coatings." It's yours for the asking.

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO **Inco Nickel**... *makes plating perform better longer*



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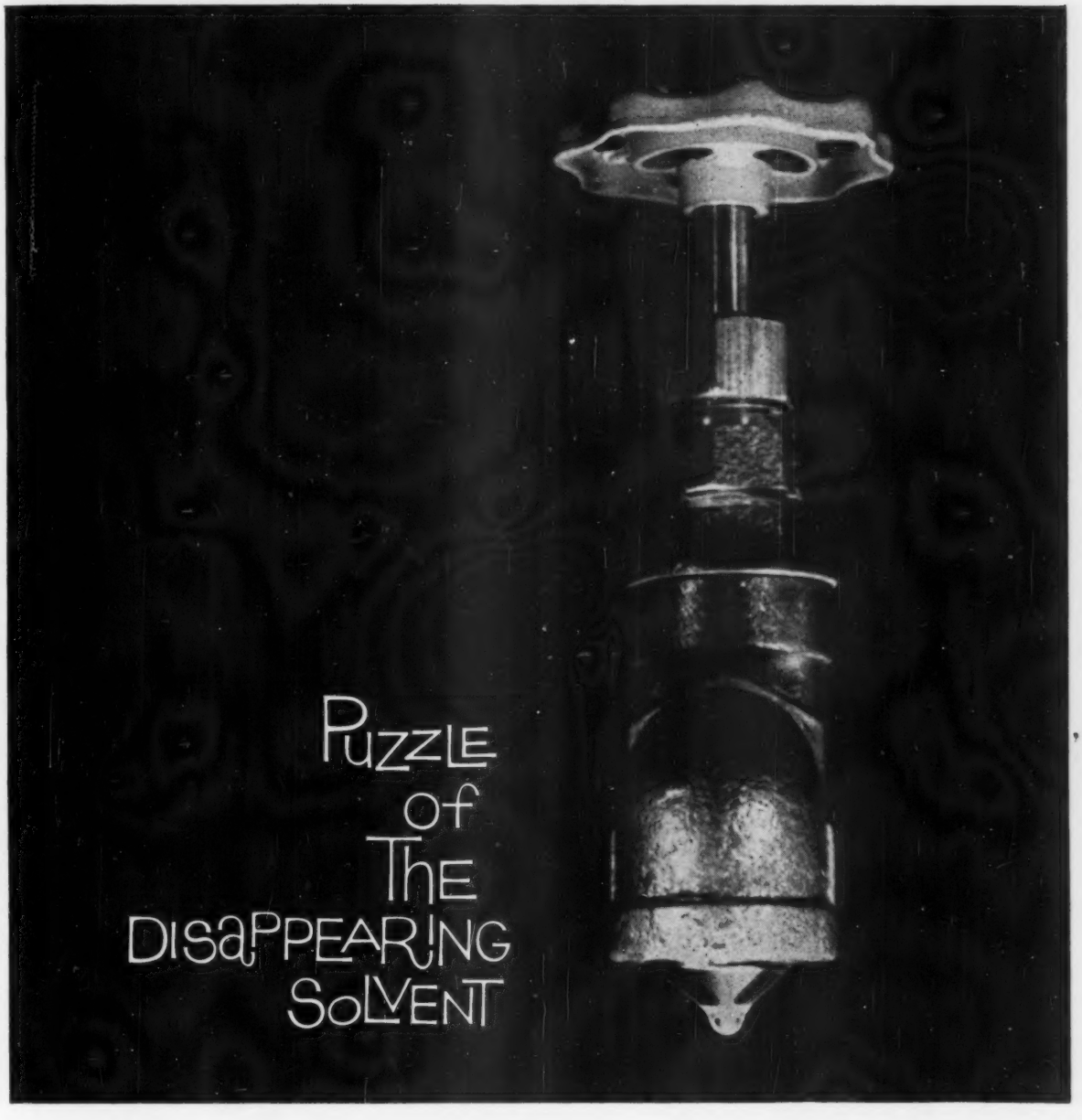

OR HOW TO DEGREASE MORE PARTS PER DOLLAR OF CLEANING COST

Every time they needed more vapor-degreasing solvent, the drum was empty, it seemed.

At first it didn't bother them much. Then, suddenly, they realized what was happening to their degreasing costs.

The solvent wasn't lasting as long as it should between bath cleanouts. That's why they had to use so much of it. Worst of all, every time a bath went sour they had to pull the degreaser off the line. That is where the real expense was lurking: in slowed-up production.

PSP TO THE RESCUE They solved the puzzle—with a degreasing solvent that can't wear out prematurely. It has permanent staying power—psp—because it's protected by a stabilizer that doesn't get used up during degreasing.

You stand a good chance of getting lower metal-cleaning cost with this solvent, too. It's called Nialk TRICHLOR. You don't have to add fresh stabilizer to it. Even when you distill the solvent, it remains stable. Even the vapor is stabilized. And you use less solvent, because less goes down the drain in unnecessary cleanouts.

Interested in finding out what you can save with this better trichlorethylene? Your Nialk TRICHLOR distributor can give you swift service on the quantity you need. Call him today.

NEW 36-PAGE BULLETIN explains fully how you get more and better vapor degreasing for the money with Nialk TRICHLOR. Shows basic types of vapor degreasers. Discusses cycles, operating procedures, stabilizers, causes of solvent contamination, solvent recovery, trouble shooting. Ask your distributor for a copy or write us.

Nialk® Trichlor, a product of

HOOKER CHEMICAL CORPORATION

1308 Union Street, Niagara Falls, New York

Sales Offices: Buffalo Chicago Detroit Los Angeles New York Niagara Falls Philadelphia Tacoma Worcester, Mass.
In Canada: Hooker Chemicals Limited, North Vancouver, B. C.

HOOKER CHEMICALS PLASTICS


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SOLVENTS
DOW
NEU-TRI
WARNING

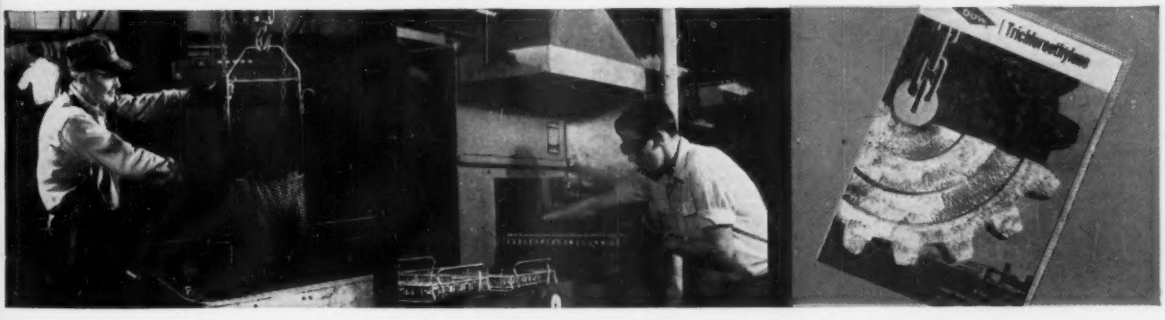
NEU-TRI

STAYS STABLE, PROTECTS AGAINST CORROSION

The super-stable *neutral* trichloroethylene from Dow —NEU-TRI®—gives you more mileage for your solvent dollar because it *stays* stable—even after prolonged periods of vapor degreasing. The powerful built-in stabilizer system in NEU-TRI protects parts and equipment from corrosion, staining and pitting . . . increases cleaning efficiency.

Dow also offers ALK-TRI®, the amine-stabilized tri with powerful solvency, and HI-TRI®, the trichloroethylene for cold cleaning missile components. HI-TRI has excellent shock sensitivity properties and leaves little or no residue.

COLOR CODED—Drums for each of Dow's chlorinated solvents are distinctively colored for easy identification—even from 100 feet away. NEU-TRI, for example, comes in blue and white drums. To help you select the right solvent for your operations, call your distributor of Dow solvents.



Chlorothene® NU, the safer solvent, can do a big job in every plant . . . for cold cleaning small metal parts, electric motors or for general maintenance. Ideal for spray, dip, wipe or bucket cleaning. Combines high safety, low toxicity.

NEU-TRI has high solvent power, low boiling point, high vapor density. This simplifies maintaining a definite vapor level, reduces amount of solvent drag-out during work transfer. Result—fewer rejects, substantial heat savings.

ASK YOUR DISTRIBUTOR of Dow solvents for this booklet on trichloroethylene. It highlights the features of NEU-TRI as a fast, efficient vapor degreasing solvent. Get in touch with your distributor or write to your nearest Dow sales office.

TURN PAGE FOR LISTING OF YOUR DISTRIBUTOR OF DOW SOLVENTS

The widest line of industrial solvents: Trichloroethylene • Perchloroethylene • Chlorothene NU • Methylene Chloride

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN DOW

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get in touch with your Dow Solvents Distributor

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LETTER KEYS: (C)—Chlorothene® NU; (M)—Methylene Chloride; (P)—Perchloroethylene (Industrial); (T)—Trichloroethylene

ALABAMA
BIRMINGHAM—Wittichen Chemical Company (C M P)
BIRMINGHAM—F. H. Ross & Company, Inc. (C M P)
MOBILE—McKesson & Robbins, Inc. (C M P T)
MOBILE—F. H. Ross & Company, Inc. (C M)
MONTGOMERY—Wittichen Chemical Company (C M P)

ARIZONA
PHOENIX—Braun Chemical Company (C M P T)
PHOENIX—Western Chemical Company (C M P)
TUCSON—Western Chemical Company (C M P)

CALIFORNIA
LOS ANGELES—Braun Chemical Company (C M P T)
LOS ANGELES—McKesson, Mefford Chemical Division (P)
LOS ANGELES—Pemaco, Inc. (P T)
SAN DIEGO—Braun Chemical Company (C M P T)
SAN FRANCISCO—Braun-Knecht-Heimann Co. (C M P T)
SAN FRANCISCO—G. N. Meacham Company (C)

COLORADO
DENVER—Braun-Knecht-Heimann Company (C M)
DENVER—Chemical Sales Company (C M P T)
DENVER—McKesson & Robbins, Inc. (C M P T)
DENVER—Mine and Smelter Supply Company (C M P T)
GRAND JUNCTION—C. D. Smith Co., Chemical Div. (C P T)

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HARTFORD—Dwight R. Judson Company (C T)
NEW HAVEN—H. Krevit and Company, Inc. (C P T)
SHELTON—Axton-Cross Company (C M P T)
SOUTH NORWALK—Guard-All Chemical Co. (C M P T)
STAMFORD—McKesson & Robbins, Inc. (C M P)
WATERBURY—Hubbard Hall Chemical Company (M)

FLORIDA
JACKSONVILLE—F. H. Ross & Company, Inc. (C M P)
JACKSONVILLE—Amica Burnett Chemical Co. (C M P T)
MIAMI—Amica Burnett Chemical Co. (C M P T)
MIAMI—Biscayne Chemical Laboratories (C M P)
ORLANDO—Atlantic Chemicals, Inc. (C M P T)
TAMPA—Amica Burnett Chemical Co. (C M P T)
TAMPA—Atlantic Chemicals, Inc. (C M P T)
TAMPA—McKesson & Robbins, Inc. (C M P T)

GEORGIA
ATLANTA—Chapman Chemical Company (T)
ATLANTA—McKesson & Robbins, Inc. (C M P T)
ATLANTA—F. H. Ross & Company, Inc. (C M P)
ATLANTA—Southern States Chemical Co. (C M P T)
BIRMINGHAM—Chapman Chemical Company (T)
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ROCKFORD—Industrial Oil & Chemical Company (C)
ROCKFORD—Viking Chemical Company (C M P T)

INDIANA
EVANSVILLE—Barning Industrial Chemicals, Inc. (C M P T)
EVANSVILLE—Charles Leich and Company (P)
FT. WAYNE—Hoosier Solvents & Chemicals Corp. (C M P)
FT. WAYNE—Inland Chemical Corporation (C M P)
HAMMOND—Inland Chemical Corporation (C M P T)
INDIANAPOLIS—Hoosier Solvents & Chemicals Corp. (C M P)
INDIANAPOLIS—Wm. Lynn Chemical Co., Inc. (C M P)
INDIANAPOLIS—Ulrich Chemical Company, Inc. (C T)
KOKOMO—Plating Products, Inc. (T)
LOGANSPORT—Plating Products, Inc. (T)
SOUTH BEND—Inland Chemical Corporation (C M P T)
SOUTH BEND—Stevens Company (C M P)

IOWA
BETTENDORF—Barton Naphtha Corporation (C M P)
BURLINGTON—McKesson & Robbins, Inc. (C M P T)
CEDAR RAPIDS—McKesson & Robbins, Inc. (C M P T)
COUNCIL BLUFFS—Barton Solvents Co. (C M P T)
DAVENPORT—McKesson & Robbins, Inc. (C M P T)
DES MOINES—Barton Naphtha Company (C M P T)
SUMNER—Overton Chemical Sales (C)

KANSAS
WICHITA—McKesson & Robbins, Inc. (C M)

KENTUCKY
LOUISVILLE—Dixie Solvents and Chemicals Co. (C M P)
LOUISVILLE—Gans Chemical and Supply Company (P)
LOUISVILLE—McKesson & Robbins, Inc. (C M P T)

LOUISIANA
BATON ROUGE—McKesson & Robbins, Inc. (C)
NEW ORLEANS—McKesson & Robbins, Inc. (C)
NEW ORLEANS—Southern Solvents and Chemicals (C M P T)

MAINE
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SPRINGFIELD—Hampden Color & Chem. Co. (C M P)
STONEHAM—George Mann & Company, Inc. (C M P T)
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WORCESTER—George H. Clark and Co. (C M P T)

MICHIGAN
DETROIT—Eaton Chemical & Dyestuff Company (C M)
DETROIT—Manpro Corporation (C M P T)
DETROIT—McKesson & Robbins, Inc. (C M P T)
DETROIT—Western Solvents & Chemicals Company (C M P)
DETROIT—Whitfield Chemical Company (P)
ESCANABA—Haviland Products Company (C M P)
FERNDALE—Manpro Corporation (C M P T)
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GRAND RAPIDS—McKesson & Robbins, Inc. (C M P T)
GRAND RAPIDS—Wolverine Solvents & Chemicals Co. (C M P)
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LANSING—Wheaton Chemical Company (C P)
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KANSAS CITY—Missouri Solvents and Chemicals Co. (C M P)
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OMAHA—McKesson & Robbins, Inc. (C M P T)

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NEWARK—National Oil and Supply Company (C M P T)
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RIVERDALE—A. H. Mathieu Company (P)
SOUTH KEARNY—American Chemicals, Inc. (C M P T)
VINELAND—Lirio Chemical Company (C P T)

NEW MEXICO
ALBUQUERQUE—Braun Chemical Company (C M P T)
ALBUQUERQUE—Edmunds Chemical Company (C M P T)

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ATHENS—Spick Products Company (P T)
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BROOKLYN—Enequist Chemical Company (C P)
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BUFFALO—Chemical Sales Corporation (C M P T)
BUFFALO—McKesson & Robbins, Inc. (C M P T)
GARDEN CITY—Hogan Industrial Supply Corp. (C M P T)
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NEW YORK—McKesson & Robbins, Inc. (C M P)
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RENSSELAER—Eastern Chemicals, Inc. (C M)
ROCHESTER—Chemical Sales Corporation (C M P T)
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UTICA—Monarch Laboratories (C M P)

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CHARLOTTE—Moreland Chemical Company (C M P T)
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DAYTON—Ottoson Solvents, Inc. (T)
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TOLEDO—Toledo Solvents and Chemicals (C M P)
TOLEDO—M. I. Wilcox Company (C P T)
YOUNGSTOWN—Rhiel Supply Company (C M P T)

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TULSA—McKesson & Robbins, Inc. (C M P T)
TULSA—Chemical Products, Inc. (C M P T)

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PHILADELPHIA—McKesson & Robbins, Inc. (C M P T)
PHILADELPHIA—Phillips and Jacobs, Inc. (C M)
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PHILADELPHIA—George Senn, Inc. (C M P T)
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PITTSBURGH—Carman-Pittsburgh Company, Inc. (C)
PITTSBURGH—Ft. Pitt Chemical Company (C)
PITTSBURGH—McKesson & Robbins, Inc. (C M P T)
READING—Textile Chemical Company (C P)
SCRANTON—Scranton Chemical Company (C P T)
YORK—Industrial Solvents and Chemicals Co. (C P T)

RHODE ISLAND
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PROVIDENCE—George Mann & Company, Inc. (C M P T)
PROVIDENCE—Sessions-Gifford Company, Inc. (C M P T)

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GREENVILLE—Southern States Chemical Co. (C M P T)
SPARTANBURG—Moreland Chemical Co., Inc. (C M P T)

TENNESSEE
CHATTANOOGA—Chapman Chemical Co. (C M P T)
CHATTANOOGA—Wilson Sales Company (C M P T)
KINGSPORT—Chem-I-Dent, Inc. (C P T)
MEMPHIS—Chapman Chemical Company (C M P T)
MEMPHIS—C. P. Hall Company (C M P T)
MEMPHIS—Ideal Chemical and Supply Co. (C M P T)
NASHVILLE—Chapman Chemical Company (C M P T)
NASHVILLE—Wilson Sales Company (C M P T)

TEXAS
AMARILLO—State Chemical Company (C M P T)
AUSTIN—R. M. Hughes Company, Inc. (C M P T)
BEAUMONT—Arthur Dooley and Son (C M P T)
CORPUS CHRISTI—McKesson & Robbins, Inc. (C M P T)
DALLAS—McKesson & Robbins, Inc. (C M P T)
DALLAS—Texas Solvents and Chemicals Co. (C)
DALLAS—Van Waters and Rogers, Inc. (C M P T)
EL PASO—Baron Chemical Company (C M P T)
EL PASO—Braun Chemical Company (C M P T)
EL PASO—Mine and Smelter Supply Company (P)
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HOUSTON—McKesson & Robbins, Inc. (C M P T)
HOUSTON—W. H. Curtin and Company (P)
HOUSTON—Dixie Chemical Company (C M P T)
HOUSTON—R. M. Hughes Company, Inc. (C M P T)
HOUSTON—Texas Solvents and Chemicals Co. (C M P)
HOUSTON—Van Waters and Rogers, Inc. (C M P T)
LUBBOCK—State Chemical Company (C M P T)
MIDLAND—State Chemical Company (C M P T)
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SAN ANTONIO—McKesson & Robbins, Inc. (C M P T)
TERMINAL—State Chemical Company (C M P T)

UTAH
SALT LAKE CITY—Braun-Knecht-Heimann Co. (C M P T)

VIRGINIA
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ROANOKE—Havnaer Supply Company (C M P T)

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SEATTLE—Van Waters & Rogers, Inc. (C M P)
SPOKANE—Van Waters & Rogers, Inc. (C M P)

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BLUEFIELD—Fairmont Supply Co. (T)
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HUNTINGTON—Cabell Chemical Company (C P T)

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APPLETON—McKesson & Robbins, Inc. (C M P T)
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LA CROSSE—Wisconsin Solvents & Chemicals Corp. (C M P)
MADISON—North Central Chemicals, Inc. (C M P T)
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MILWAUKEE—McKesson & Robbins, Inc. (C M P T)
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AUGUST, 1960 Volume 58 No. 8

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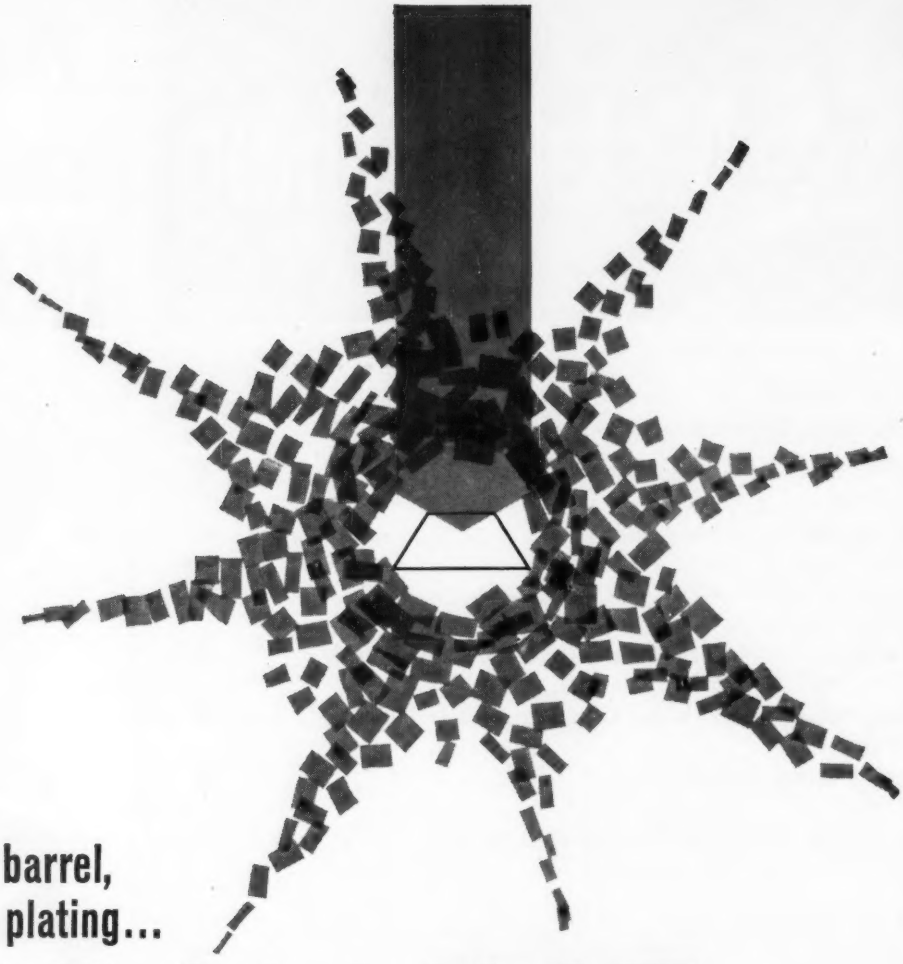

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DEPRECIATION REFORM

Readers of this page may have noted that the editor prefers to concern himself with matters technical and pertinent to the field we try to serve, and to leave comments on the political scene to the editorial writers of the daily press. Not only do we consider ourselves unqualified in the latter area, but we believe the subscriber to a magazine such as *Metal Finishing* expects from us a concern with his specific interests in the art.

A number of years ago we added our own small voice to the protest of the whole scientific fraternity at the injection of politics into the National Bureau of Standards, but this was not really a deviation from our policy, since our industry has benefited enormously from the work of the Bureau and, therefore, could be considered directly concerned. Again, a situation has arisen which calls for comment — the matter of machinery and equipment depreciation — which appears to have become a political football.

The policy of our country with respect to depreciation is probably the most backward on earth. While the rest of the world has taken action to permit larger write-offs, so that industry may be enabled to meet rapidly rising costs of replacement and modernization resulting from inflation, our own Treasury Department has fought a delaying action against liberalized depreciation, although its argument of loss of tax revenues has been disproved time and again. Sixteen years ago Canada recognized the imperative need of replacing obsolete machinery in order to keep production costs low. Yet, despite depreciation rates which are twice ours and more, no hardship has been created on the national treasury.

There have been public hearings, and the U. S. Senate Select Committee on Small Business has recommended that a similar system be considered, but the prospects of improving our depreciation laws, especially in an election year, appear quite poor. Therefore, while most countries permit complete write-off in ten years or less, our nation continues to insist that the useful life of a polishing machine is 15 years, that of electrical equipment 17-20 years, and filters and dust-collecting systems a full two decades. And, this at a time when replacement costs have risen four or five hundred per cent.

The application of sound tax economics does not cheat the Treasury or the taxpayer in any way, and action is urgent. We hope that, once the elections are over, our lawmakers will forget political expediency for a while and get down to the business of correcting the situation. Depreciation reform is long overdue.

Nathaniel Hall

Institute of Metal Finishing Conference, Scarborough 1960

By R. Pinner, *Technical Editor, "Electroplating and Metal Finishing,"*

THE 1960 Annual Conference of the British Institute of Metal Finishing was held at the Grand Hotel, Scarborough, Yorkshire, from April 26th to 30th. Flanked by the Yorkshire moors, Scarborough is a pleasure resort on the English north-east coast and its wild cliff scenery provided an ideal setting for the Conference.

About 300 delegates took part, including visitors not only from most European countries but from as far as Australia, South Africa, and India. American visitors also attended in some force and, apart from *Dr. H. Brown* and *D. R. Millage* who gave a paper on the corrosion resistance of nickel-chromium coatings, the Conference provided a meeting away from home for *Mr. & Mrs. Myron B. Diggin* who visited Scarborough as part of an extended European trip, *C. H. Sample*, *A. C. Benning*, and *A. M. Weisberg*.

Of the fourteen papers presented at the technical sessions, three dealt with aspects of nickel-chromium plating, two others with tin coatings, two with the sealing of anodized aluminum, and one each with the growth of copper deposits, conversion coatings, and pre-coated steels. Four others were contributed by the Institute's Organic Finishing Group, including an important paper by *Dr. U. R. Evans*, pioneer and Grand Old Man of corrosion research.

ABSTRACTS OF TECHNICAL PAPERS

Methods of Obtaining Improved Outdoor Resistance with Nickel + Chromium Plate

By H. Brown & D. R. Millage,
(Udylite Research Corp., Detroit, U.S.A.)

An investigation into the corrosion resistance of a number of nickel-chromium plating systems was reported, including

Left to right: A. A. B. Harvey, president of the Institute of Metal Finishing, the Deputy Mayor of Scarborough, Dr. T. P. Hoar, immediate past-president of the Institute.

(a) Watts nickel polished and plated with 0.01 mil chromium, (b) nickel or copper-nickel plated with 0.03-0.1 mil crack-free chromium, (c) nickel or copper-nickel plated with dual chromium, and (d) chromium-nickel-chromium. Outdoor exposure tests, including marine exposure at Kure Beach, industrial exposure at Detroit and mobile tests as well as CASS (copper accelerated acetic acid salt spray) Corrodkote and SO_2 test results were compared.

The results showed that:

Crack-free chromium gave good results over 1 mil bright nickel plated at a thickness of 0.08 mil crack-free chromium. However, to achieve an average of 0.08 mil, high current density areas may receive 0.2 mil deposits which are blue and highly stressed. An average 0.03-0.05 mil, therefore, is normally plated which does not give sufficient improvement to warrant reducing nickel thickness, though good results are obtained on 1 mil copper-1 mil nickel deposits.

Duplex nickel with 0.01 mil chromium gave better results at Kure Beach as well as in the CASS and Corrodkote tests, than in industrial atmosphere in which the main advantage of the duplex coating is its high ductility.

Dual Chromium gave increased protection at a total thickness of at least 0.025-0.03 mil. Under SO_2 test, crack-free chromium was superior to dual chromium, but early results of outdoor exposure tests reverse this. Duplex nickel-dual chromium is not yet used.

Chromium-nickel-chromium is stated to offer the best atmospheric corrosion resistance but only pilot plant data are yet available. On zinc-base alloy a first coat of 0.3-0.5 mil copper, brass, bronze or nickel is plated, a crack-free 0.03-0.05 mil chromium deposit is then applied, the parts are rinsed, dipped in alkaline hydrosulphite solution, rinsed, plated in a low pH nickel strike, followed by 0.8 mil bright or semi-bright nickel, and finally plated with 0.01 mil chromium. On steel, too, a preliminary copper, brass, or nickel deposit gives the best results.

The conclusions reached included that, in marine atmospheres, the use of (i) 0.01 mil chromium plated at 120-140°F. and a catalyst ratio of 125-175 to 1 and (ii) sulphur free or duplex nickel gave the best results.

In industrial atmospheres, sulphur-free or duplex nickel gives little improvement, but the crack pattern of the chromium and the thickness of the nickel are the important factors.

In the mobile tests, which combined industrial exposure with the effect of salt laid on the roads for de-icing, duplex nickel with 0.01 mil chromium gives good results, crack-free chromium being of less value.

In the discussion M. B. Diggin pointed to the effect of the potential difference between semi-bright sulphur free and bright nickel deposits, while C. H. Sample thought galvanic corrosion effects were perhaps being over-emphasized.

Factors Influencing the Corrosion Resistance of Decorative Plating on Zinc-Alloy Die Castings

By Osman J. Hones, V. E. Carter and J. Edwards,
(The British Non-Ferrous Metals Research Association, London)

An investigation was reported dealing with the effect on the corrosion resistance and appearance of plated zinc base alloys of —

(i) the structure of the basis metal and the presence of a number of different casting defects

(ii) increasing the thickness of the chromium coating

and replacing the copper undercoat by direct nickel plating.

While some specimens were plated industrially, others were prepared in the laboratory and corrosion resistance was assessed by exposing them to the atmosphere at Euston, London (Industrial) and Hayling Island (Marine). The value of the coating was assessed visually and the specimens were rated with the aid of a 'weighting' which differed according to the type of defect.

The results showed that defects in the surface of the basis metal and minor plating defects had little influence on the rate of deterioration of the system. The results of tests on the specimens which had been plated by different methods showed that, with conventional chromium of normal thickness, small variations of thickness can have a major effect on the rate of breakdown. 'Crack-free' chromium gave superior results due, it is believed, to the higher thickness that can be plated without cracking. A thickness of 0.05-0.1 mil is likely to be optimum, but the benefits achieved vary with the shape of the part. A minimum thickness of at least 0.03 mil is therefore recommended.

In each case it was found that an increase in nickel thickness improved corrosion resistance substantially. On the other hand, substitution of copper by direct nickel resulted in reduced adhesion (under the conditions of the test) but had little effect on the corrosion resistance of the system.

Sealing Anodic Oxide Films on Aluminum

By G. C. Wood (Cambridge University)

In this paper the author gave a comprehensive literature review of the sealing mechanism and discussed the changes that take place during the process. The author dealt with the nature of the barrier layer, and models illustrating the pore structure were shown. He then discussed the chemical composition and structure of the anodic oxide coatings and reviewed theories of the formation of porous layers. In the second part of the paper a number of theories on the mechanisms were reviewed, based on investigations of weight change, electrical and permeability measurements, corrosion resistance tests, the study of dye adsorption, and electron diffraction. The author concluded that the change in properties of anodic films, referred to as aging, appears to be associated with the movement of ions in the layer after anodizing, together with the adsorption and absorption of water, which were believed to be due to physical rather than chemical effects. On heating in hot water or steam, however, the changes are much more radical. Partial or complete hydration of the film to give Böhmite occurs, and this is accompanied by a large reduction in porosity.

When the coating is sealed in other electrolytes, hydration is probably accompanied by other reactions, e.g., with nickel acetate the deposition of nickel hydroxide formed by hydrolysis, and with sodium silicate the formation of aluminum silicate are important. When dichromate/chromate mixtures are employed, the inhibitive action of the chromate ions and their reaction with the walls to give aluminum oxydichromate or oxychromate must also be considered.

On the Assessment of Sealing of Anodic Oxide Films on Aluminum

By T. P. Hoar and G. C. Wood (Cambridge University)

In this paper, a colorimeter method was described for determining the degree of sealing on anodic oxide coatings on aluminum. The method was tested on chemically polished and sulfuric acid anodized coatings which had been sealed in boiling water or nickel acetate solution. The specimens are post-sealed by immersing them for 10 minutes in a 50 g./l. potassium dichromate solution at 95°C., after which they are washed and dried.

In the case of water sealed coatings, the chromium picked up in post-sealing is determined using diphenylcarbazide with a Spekker photoelectric absorptiometer. The amount of chromium which has been picked up by the coating is determined by dissolving the film in a 10 ml 3 M sodium hydroxide solution. The solution is then acidified with 25 m. 15% w/v sulphuric acid and the diphenylcarbazide color is measured.

The authors assume that the pore sectional area should be proportional to chromium uptake of the cylindrical pores seal mainly in an inward direction. As well as the laboratory test described, the authors proposed a simple practical test to control the efficiency of water sealing in which chromate post-sealing shows up a poorly-sealed film by a visible color.

Left to right: H. C. Castell (Chairman, Conference Technical Sub-Committee), Dr. J. E. Garside (Hon. Treasurer of the Institute), Dr. S. Wernick (Hon. Secretary of the Institute).

The Growth Habit of Electrodeposited Copper

By G. G. Storey and S. C. Barnes, (Joseph Lucas, Ltd., Birmingham)

The effect of operating conditions on the structure of copper deposits from acid copper plating baths was reported on in this paper. The basis metal was polycrystalline strip and plating was carried out under conditions close to those obtained in industry. After plating on electropolished as well as on mechanically polished specimens, the coatings were examined by microscope, x-ray diffraction, optical goniometry, and sectioning.

When plating from acidified copper sulfate solutions under base reproduction conditions, the structure formed on the individual grains of a polycrystalline cathode were shown to be identical to those formed on single crystal cathodes of the same orientations.

The variation of structure with cathode orientation in treated high-purity solutions differed from that obtained in ordinary baths of this type, particularly on surfaces inclined at more than 20° to a (100) plane. However, in both types of solution the deposit thickness varied over the surface of a polycrystalline cathode due to differences in electrochemical anisotropy.

Growth, on the whole, is similar on electropolished and etched cathodes. On the other hand, a mechanically polished substrate gave a polycrystalline textured deposit, although some base influence could be detected through thick deposits.

If the current density was sufficiently low, base reproduction could be obtained in deposits formed from an industrial cyanide copper solution. The formation of polycrystalline material can occur after long plating times, but is sensitive to the orientation of the grains of the basis metal. As in acidified copper sulfate solutions, the growth habit of the deposit is very sensitive to the cathode orientation and, on many surface planes, large facets form which coarsen with plating time.

Furthermore, the deposition process is strongly influenced by impurities in the cathode surface. A number of photomicrographs illustrated this paper.

The Throwing Power of Nickel & Other Plating Solutions

By S. A. Watson (Mond Nickel Co., Ltd. Development & Research Dept., Birmingham)

A method for determining the throwing power of plating solutions with the aid of an open Hull cell was described. The primary current distribution was determined on a conducting paper model of the cell. A plastic 267 ml Hull cell

was held in a plastic plating tank fitted with air agitation, and polished brass sheet cathodes were used which were scribed with vertical lines 0.25″ apart, faced with an acid deposit sawn into horizontal strips, which were mounted, polished, and etched, and the deposit thickness measured microscopically. The throwing power was then calculated from the variation in deposit thickness. The authors used the new method to compare nickel, cobalt-nickel, tin-nickel, copper, and chromium plating solutions, and studied the effects of operating variables.

Among nickel baths, citrate, fluoborate, all-chloride, and high-speed solutions were slightly superior to the Watts bath. High sulfate nickel baths containing sodium sulfate and, to a lesser degree, magnesium were also superior, but attempts to improve throwing power by complexing nickel ions with fluorides and other anions failed. Tin-nickel had a higher throwing power than the Watts nickel bath.

Aging slightly decreased the throwing power of Rochelle copper and chromium plating baths. In the Watts nickel bath, agitation had little effect and addition of thiourea had little effect below concentrations in which brittle deposits are obtained. Coumarin affected throwing power adversely, saccharin had little effect. Two proprietary baths showed inferior throwing power as compared with the Watts bath. The effect of both coumarin and thioruea on throwing power was found to be related to the effect on cathode potential.

Among chromium plating baths the Bornhauser tetrachromate solution was superior to the conventional chromium bath. In the discussion that followed this paper, *Dr. T. P. Hoar* commented on the need for more practical tests for metal distribution on complex articles.

Detection of Zinc Diffusion into Tin Coatings on Brass

By S. C. Britton & M. Clarke,
(Tin Research Institute, Greenford, Middlesex)

While tin coatings are often applied to brass to facilitate soldering, a problem that arises is the diffusion of zinc into the tin. This may affect the soldering properties, and in this paper a method is devised which has been developed to detect the extent of this diffusion. The method depends on the fact that the corroding potentials, in 0.001% NaCl solution, of tin containing small amounts of zinc, are initially zinc-like and become tin-like only after immersion in the solution for a time which depends on the zinc content.

Potential measurement can be used to detect the diffusion of zinc into tin coatings on brass during flow-brightening or long storage. The small amount of diffusion on storage detected by this means are sufficient to cause, in exposure to copious condensation of moisture, the formation of corrosion products which make soldering more difficult although they do not affect the soldering of the coating if it is stored normally. Thus, a 0.1-0.2 mil tin coating on brass, flow-brightened, had sufficient zinc in the surface to detect by measurement of corroding potential.

A flash copper coating on the brass prevented diffusion during flow-brightening.

The Solderability of Some Tin, Tin Alloy and Other Metallic Coatings

By C. J. Thwaites,
(Tin Research Institute, Greenford, Middlesex)

A spread-of-drop type test has been used to compare the solderability of tin, tin-alloy, cadmium, and silver. The influence of coating thickness, basis metal, undercoat layers, and after-treatment was studied and some specimens were stored for period up to two years to examine the effect of storage on solderability.

The result showed that hot-dipped or electroplated tin coatings of 0.3 mil thickness or more were superior and least influenced by basis metal, undercoat, or storage. On the other hand, there seemed to be no advantage in using tin alloy coatings if the sole object was to improve solderability.

Coatings on steel or over a nickel undercoat were not affected appreciably by storage, whereas, coatings on copper or over a copper underlayer slowly decreased in solderability, especially at 50°C., due to formation of intermetallic compound and

Left to right: Myron B. Diggin (Hanson-Van Winkle Co.), W. K. Bates (Albright and Wilson [Mfg.] Ltd.), Mrs. Diggin, F. W. Wells and P. F. Walmsley (Albright and Wilson [Mfg.] Ltd.), R. Pinner.

loss of free tin. This deterioration was only serious with coatings less than 0.3 mil thick.

On brass the solderability of electro tin may deteriorate after storage, due to zinc diffusion and the action of atmospheric moisture when storage conditions are unsuitable. A 0.1 mil thick copper undercoat beneath electroplated tin or alloy coatings or a 0.1 mil nickel layer under hot-dipped tin coatings are beneficial, and the latter helps to prevent contamination of the dipping bath by zinc.

On copper, a decrease in solderability is due to loss of coating as tin-copper intermetallic compound, particularly when the coating thicknesses is below 0.3 mil.

A 0.1 mil nickel undercoat gives an improvement in initial solderability but the final coating should be applied without any delay. A 0.1 mil copper undercoat also improves initial solderability of steel and brass but solderability is low when thin coatings are plated direct on massive copper.

Flow-melted tin coatings show slightly superior storage properties compared with as-plated coatings of a similar thickness when both are on copper. On steel and brass, there appears to be no advantage.

Where the coating system is chosen for other reasons and deterioration is envisaged, the parts should be stored at 25°C. to prevent condensation, and for the least possible time. Humidity and atmospheric contamination should be kept low, e.g. by storing in inert containers containing a drying agent.

Studies on the Surface Treatment of Aluminum & Zinc

By D. B. Freeman and A. M. Triggle
(Pyrene Co. Ltd., Brentford, Middlesex)

Progress in chromate and phosphate conversion coatings on aluminum and zinc was reported.

Aluminum: The main types of coating currently used are:

(a) Chromate-oxide coatings (M.B.V. type) produced from alkaline chromate solutions. These have been widely used before painting but operating temperatures are high and the solutions cannot be sprayed:

(b) Zinc phosphate coatings used mainly for coating mixed assemblies of aluminum with other metals;

(c) Chromate-phosphate-fluoride coatings, which vary from light iridescent to matte 'architectural' green: A recent advance is that, in larger installations, the solution can now be pumped through a cation exchange unit to keep metal concentration constant and coating color uniform;

(d) Chromate-fluoride coatings, iridescent to golden-yellow or brown. These are rapidly increasing in importance, as they are formed more rapidly and at lower temperatures. In high speed strip lines these are applied by 10 second spray or 30 second immersion at 60-120°F.

Investigation showed that paint adhesion was best on anodized surfaces, followed by thick chromate-fluoride coatings. Both these treatments were also best for reducing paint failure under salt spray. Without paint, chromate-oxide and

chromate-phosphate retained their appearance best and are preferred for decorative applications.

Zinc: Chromate coatings for zinc are of the following types:

(a) green-yellow films from a 200 g./l. dichromate-sulphuric acid solution;

(b) 'olive-drab' films produced with the aid of organic addition agents;

(c) Colorless film produced from highly concentrated chromic acid baths;

(d) Very thin iridescent films produced by bright-passivation on zinc plate using concentrated chromic-nitric acid solutions.

A recent development is the use of more dilute solutions and control of color by ratio of hexavalent chromium to other anions. Golden yellow films are produced from 20 g./l. chromic acid-chromic sulfate solutions. Colorless films from 12 g./l. solutions, or in the presence of ammonium sulfate.

The best corrosion resistance is obtained by sodium chromate-sulfuric acid and acid-chromic sulfate-ammonium sulfate (Cr^{6+}:SO_4 ratio 0.9) solutions. Of colorless coatings, chromic acid-chromic sulfate solutions (ratio:0.5) are best.

Properties and Use of Aluminum Paste Pigment in Organic Finishes

By G. E. Garden and A. W. Brace, (Aluminum Laboratories Ltd., Banbury)

Aluminum paste pigments are produced from 99.5% aluminum powder which is reduced to flakes by stamping or hammering in the presence of stearic acid with, e.g., white spirit. The pigment has a flake diam. 75-100 times the thickness, and an area of 14,000 sq. cm./g. Leafing is due to the stearic acid and produces a metallic surface free from lacquer. Deleafing, which imparts a polychromatic effect, is accomplished by replacing the stearic acid by, e.g., caproic acid. Good reflectivity and low heat emmissivity are obtained this way.

Non-leafing aluminum priming paints are used with zinc oxide or basic lead sulfate on structural steel. A leafing aluminum top coat performs well on this finish.

Vehicles must be of low viscosity, with a water content below 0.1%, free from polar or acid groups and lead driers, of high surface tension and compatible with white spirit. Coumarone, ester gum, terpene and petroleum, and phenol-formaldehyde resins are suitable, but alkyds must be of low residual acidity. Tung oil is particularly suitable as a drying oil. Linseed or boiled linseed oil can be added. Only cobalt napthenate or octoate can be used as drier. Oxygen-containing thinners must be avoided. Bituminous vehicles can be used, Gilsonite or Trinidad Asphaltum are more suitable than cold tar bitumens.

A hammer-type finish is obtained from a deleafed paint in a transparent vehicle containing two immersible solvents. Recently, aluminum paste has been rendered stable in the resin droplets of water-based emulsion paint, and this is used for packaging.

An Assessment of Coated Steel Sheets & Their Use in Industry

By F. H. Smith & T. C. Tapp (John Summers & Sons Ltd.)

The types of coated steel sheet and strip now available in the U.K. were summarized. These include the following systems:

Zinc Hot-dipped, with a bright spangled surface used for building, roofing, ducting, cold formed sections, farm equipment, etc. *Electroplated*, with a smooth, dull grey finish 0.1 mil or thicker for domestic appliances, petrol tanks, underbodies, etc.

Tin Hot-dipped and *electrolytic* with a bright finish for tins, containers, toys, etc.

Tin-terne Hot-dipped, (40/60 tin-lead), with a semi-bright finish for petrol tanks, signs, etc.

Aluminum Hot-dipped for radiant heaters, oven-liners, and roofing.

Copper- Nickel and Chromium, either polished or unpolished for trim, e.g., in can interiors, electric fires, toasters, etc.

Paint applied by *roller coating* in various colors for radio components, car trim, etc.

Plastics, P.V.C. coil laminated to steel coil in many different colors, embossings, and prints, with 10 mil and thicker coatings for partitioning, panelling, domestic equipment, switch panels, furniture, drums, chemical uses, decorative trim, etc.

Sheared edges are best protected by P.V.C. adhesive tapes, paints being unsatisfactory. Plastic sheet which is coated one side only may be protected on the under side by phosphating, zinc-chromate primer, electro-zinc coating, galvanizing, or baked enameling.

In dip aluminizing carried out in the U.S.A., 1 mil coatings are claimed to give better protection than zinc for outdoor corrosion, and the surface can be anodized and welded. Copper-coated strip has been used in the U.S.A. for tubing, while flash-nickel plated sheet is used for porcelain enameling.

The Economic Advantages of a Sound Painting Scheme

By U. R. Evans (Cambridge)

The author recalled a mathematical analysis by *A. V. Blom* [Bull Assoc. Suisse Elect, **25**, 365 (1934)] which calculates the extent to which the use of more expensive paints is justified, and discussed independent tests carried out at the British Iron and Steel Research Association, [J. C. Hudson, and F. Fancutt, 'Protective Painting of Structural Steels' and 6th Report B.I.S.R.A. Corrosion Comm. Iron and Steel Inst. Spec. Rpt. No. 66 (1959)] which can be used as a basis for such a calculation.

In order to extend the interval between paintings, the factors which cause premature breakdown must be avoided. These are:

(a) *Alkaline softening and peeling*, met with under marine conditions and characteristic of oil paints. Ship paints, therefore, should be based on nonsaponifiable vehicles. However, oil paints provide excellent protection on land, due to the inhibitive properties of lead salts of dibasic azelaic acid and derivatives of pelargonic acid which are formed on degeneration products of the soaps.

(b) *Rusting at gaps*, particularly below mill scale. While this can be avoided by the use of metal-pigmented paints, gap protection may disappear when the metallic paint is covered with a decorative colored paint.

(c) *Humping up of the coats*, due to rust formation under the paint coating at the site of salt nests, e.g. ferrous sulfate.

(d) *Gas blistering* of, e.g., paints pigmented with metallic zinc. This may arise around the margins of ferrous sulfate nests and is due to hydrogen evolved in reduction of the ferrous sulfate to iron metal.

Surface preparation is of primary importance as is selection of paint, which should be based either on existing data or on an understanding of the electro-chemical corrosion merchanism.

Water-Thinned Coatings as Industrial Finishes

By E. L. Farrows (British Paints Ltd.)

14% of paints sold in the U.K. in 1959 were water-thinned. However, industrial paints of this type are only now being developed. They have the advantage of non-flammability, freedom from odor, cheapness, and the fact that drying between phosphating or wet sanding and painting is rendered unnecessary. On the other hand, the use of such paints often requires a change in plant lay-out.

Water-thinned paints are of two types:

(a) Water-dispersible paints are based on styrene, butadiene, acrylic, acrylic copolyers, p.v. acetate, vinyl copolymer, and alkyd resins. These now have improved flow characteristics and anti-foaming agents are added.

(b) Water-soluble paints are based on film-formers containing hydrophilic groups, e.g., produced by maleinization of drying oil systems. They contain no pigment-wetting agents, protective colloids, or film coalescent agents, and have a higher degree of water resistance.

In the U.K. at present, water-thinned coatings are available as sealers for coatings, as red-oxide car body primers and primer surfacers, and as white or off-white domestic appliance primers. Glass-finishing systems are now being developed.

Water-thinned coatings are applied by dipping and spraying and, to a smaller extent, by brushing and flow coating. Primer

(*Continued on page* 43)

Sealing Anodized Aluminum

By Fred Pearlstein, *Chemist, Pitman-Dunn Labs., Frankford Arsenal, Philadelphia, Pa.*

ANODIC coatings on aluminum require a sealing treatment in order to provide superior corrosion resistance. The most effective of the commonly used seals consists of immersion in hot sodium dichromate solution. Corrosion is retarded owing to the presence of corrosion inhibiting chromate ions adsorbed in the oxide coating. The salt spray corrosion resistance of anodized aluminum, dichromate sealed, is generally greater than 240 hours. However, if the anodized aluminum is placed in contact with a more noble metal, such as copper, corrosion generally occurs within 48 hours' salt spray exposure.

If the pores in the anodic coating could be effectively sealed while corrosion inhibiting chromates are present, perhaps considerably greater resistance to dissimilar metal corrosion would be effected. The use of double sealing techniques was investigated and the results reported herein.

Experimental Work and Discussion

Aluminum panels (4″ x 6″) of 2024 alloy were anodized in 15 per cent by weight sulfuric acid at 12 amp./ft.^{2}. The panels were anodized for 30 minutes at 70°F.

The double seal was accomplished by using 5 per cent sodium dichromate solution as either the first or second (hereafter called "pre-" and "post-") seal and one of a number of other selected dispersions or solutions as the other seal. Each of the two seals was applied by ten minute immersion in the solution at the boiling point. The panels were rinsed after each seal.

A two-inch diameter copper disc was attached to the center of each aluminum panel by means of a plastic nut and bolt. The panels were exposed to salt spray and examined periodically for corrosion of the aluminum at the periphery of the copper disc.

Tables I and II show the results of the salt spray

TABLE I

Galvanic Corrosion of Anodized Aluminum Presealed in 5% Sodium Dichromate and Post-sealed in Various Other Solutions

Post-Sealing Solution	*Galvanic Corrosion* During Salt Spray Exposure of* 6 Hours	24 Hours	48 Hours
5 g./l. gelatine	none	mod	con
	none	none	sl
	none	mod	mod
2 ml./l. stearyl dimethyl benzyl ammonium chloride	none	mod	mod
	none	mod	mod
	none	none	v sl
20 g./l. sodium molybdate	none	mod	mod
	none	none	sl
	none	none	v sl
2 g./l. diglycol stearate	none	none	con
	none	sl	sl
	none	sl	mod
7 g./l. wax emulsion + 5 g./l. sodium alcohol sulfate	none	none	con
	none	sl	sl
	none	v sl	sl
10 ml./l. tetrafluoroethylene dispersion	none	none	sl
	none	sl	sl
	none	sl	mod
10 ml./l. polyethylene emulsion (20%)	none	none	sl
	none	sl	sl
	none	sl	mod
140 ml./l. waterglass	none	none	none
	none	none	none
5 g./l. nickel acetate	none	none	v sl
	none	sl	sl

*Code: v sl—very slight; sl—slight; mod—moderate; con—considerable.

TABLE II

Galvanic Corrosion of Anodized Aluminum Presealed in Various Solutions and Post-sealed in 5% Sodium Dichromate

Presealing Solution	Galvanic Corrosion During Salt Spray Exposure of 6 Hours	24 Hours	48 Hours
5 g./l. gelatine	none	v sl	sl
	none	v sl	sl
	none	mod	mod
1 ml./l. stearyl dimethyl benzyl ammonium chloride	none	none	v sl
	none	none	v sl
	none	none	v sl
1 ml./l. alkyl aryl polyethylene glycol	none	none	none
	none	none	none
	none	none	none
1 g./l. sodium lauryl sulfate	none	none	mod
	none	none	sl
	none	none	sl
Water	none	none	none
	none	none	none
	none	none	none
20 g./l. sodium molybdate	none	none	none
	none	sl	sl
	none	sl	sl
140 ml./l. waterglass	none	none	sl
	none	none	sl
	none	none	v sl
5 g./l. nickel acetate	none	none	none
	none	none	none
	none	none	none

tests after 6, 24, and 48 hours' exposure.

Several of the double-seal systems enabled the anodized aluminum, in contact with copper, to withstand 48 hours exposure to salt spray. None of the dispersions of organic materials were among the most effective seals.

Some observations during the double sealing operations are worthy of mention. When panels were presealed in dichromate, the post-seal usually resulted in leaching out most of the dichromate. Exceptions were the postseals in wax or polyethylene, where little leaching was observed. When the anodized panels were presealed in waterglass, subsequent dichromate treatment failed to impart the characteristic color to the panel, indicating that waterglass is preferentially adsorbed.

The most effective of the sealing treatments were reapplied to anodized aluminum. The panels were placed in contact with copper discs as before and exposed to salt spray. Also included in the corrosion test for comparison were dichromate sealed panels. The results of the tests are shown in Table III.

TABLE III

Results of Repeat Galvanic Corrosion Tests of Anodized Aluminum with Selected Seals

Presealing Solution	Post-sealing Solution	Galvanic Corrosion During Salt Spray Exposure of 24 hrs.	48 hrs.	72 hrs.	96 hrs.	142 hrs.
50 g./l sodium dichromate		v sl	sl	con	con	con
		none	sl	mod	mod	mod
		none	sl	mod	mod	mod
Water	50 g./l. sodium dichromate	none	none	none	sl	mod
		none	v sl	mod	mod	mod
		v sl	sl	mod	mod	mod
5 ml./l. alkylaryl polyethylene glycol	50 g./l. sodium dichromate	none	none	none	none	v sl
		none	none	none	none	none
		none	none	v sl	sl	sl
5 g./l. nickel acetate	50 g./l. sodium dichromate	none	none	none	none	none
		none	none	none	none	v sl
		none	none	none	none	v sl
50 g./l. sodium dichromate	140 ml./l. waterglass	none	v sl	v sl	sl	mod
		none	none	v sl	sl	mod
		none	v sl	v sl	mod	mod

The greatest improvement in corrosion resistance was afforded by presealing in alkyl aryl polyethylene glycol or nickel acetate followed by the dichromate post-seal. The salt spray exposure time for failure was approximately doubled. Figure 1 shows the condition of the panels after 142 hours' salt spray exposure after disassembling and cleaning off the corrosion products.

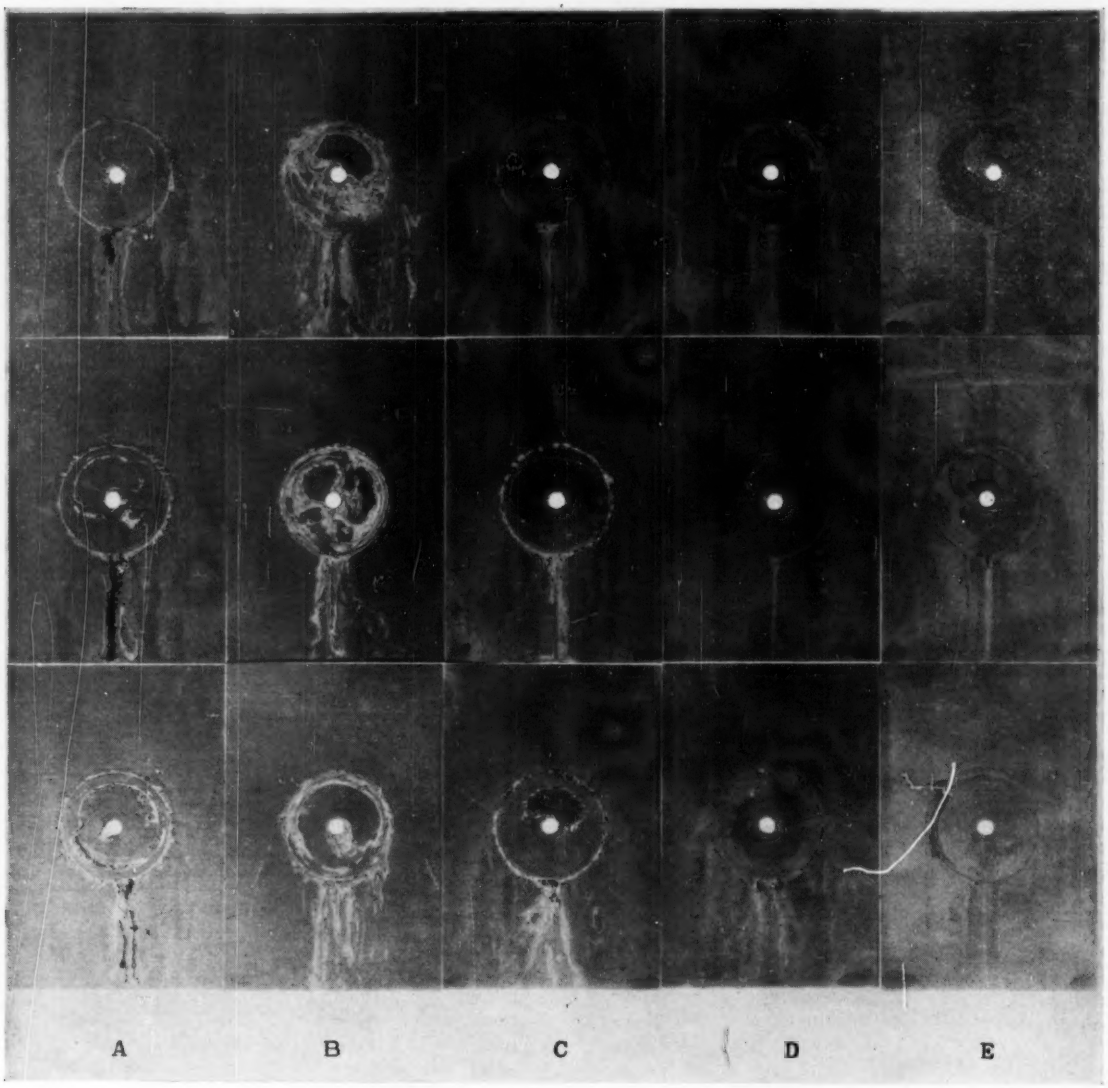
Frictional Characteristics

It was noted that sealing anodized aluminum in suspensions of tetrafluoroethylene, polyethylene, wax, and diglycol stearate resulted in a considerable increase in lubricity of the surface. In order to obtain a measure of the relative ability of the abovementioned seals to increase lubricity, an apparatus was set-up whereby a ¾ inch diameter chromium plated steel ball was drawn slowly over the treated panel. The force required to overcome sliding friction with a

TABLE IV

Coefficients of Friction of Sealed Anodized Aluminum

Sealing Suspension	*Coefficient of Friction*
50 g./l. $Na_2Cr_2O_7$	0.72
5 ml./l. tetrafluoroethylene dispersion	0.07
5 ml./l. polyethylene emulsion (20%)	0.14
1 g./l. diglycol stearate	0.09
7 g./l. wax emulsion + 5 g./l. sodium alcohol sulfate	0.18



Galvanic corrosion of sealed anodized aluminum after 142 hours salt spray exposure.

A—Dichromate sealed
B—Dichromate and silicate sealed
C—Water and dichromate sealed
D—Alkyl aryl polyethylene glycol and dichromate sealed
E—Nickel acetate and dichromate sealed

4.5 pound normal force was measured and the coefficients of friction calculated.

Specimens were prepared by sealing the anodized aluminum in the suspensions for five minutes at the boiling point. The results of friction tests on the specimens are shown in Table IV.

It can be seen from the table that all of the sealing treatments reduced the coefficient of friction over that of the dichromate-sealed specimen by from 75 to 90 per cent.

The diglycol stearate is incompletely dispersible and floating material was picked up during treatment, resulting in unpleasant-appearing streaks. The tetrafluoroethylene in suspension tended to coagulate with use. The polyethylene and wax suspensions were quite stable.

Treatment of anodized aluminum in tetrafluoroethylene suspension by immersion at 150°F. for two minutes, then allowing to dry without rinsing, was also effective for increasing the lubricity of the surface. Some advantages to this treatment over the boiling solution are better stability because of lower temperature, and equal effectiveness with lower concentrations of tetrafluoroethylene.

Preliminary tests indicate that certain of the suspension treatments are also effective for increasing the lubricity of bare steel and aluminum. For example, steel or aluminum immersed in boiling polyethylene suspension, even after rinsing, retained considerable lubricity.

Conclusions

Some of the double-seals tested imparted increased corrosion resistance to anodized aluminum in contact with copper. The greatest improvement was produced by presealing in alkyl aryl polyethylene glycol or nickel acetate, and post-sealing in sodium dichromate solution.

The lubricity of anodized aluminum was markedly increased by use of certain sealants. Five minute immersion at the boiling point in suspensions of tetrafluoroethylene, polyethylene, wax, or diglycol stearate decreased the coefficient of friction by 75 to 90 per cent over that of dichromate sealed anodized aluminum.

Even bare aluminum and steel were made considerably more lubricous by treatment in polyethylene suspension.

Acknowledgement

The author wishes to express appreciation to the Ordnance Corps for permission to publish this material.

SOURCES OF MATERIALS

Material	*Trade Name*	*Supplier*
Stearyl dimethyl benzyl ammonium chloride	Triton X400	Rohm & Haas Co., Philadelphia, Pa.
Diglycol stearate		Glyco Products Co., Brooklyn, N. Y.
Wax emulsion	#4647A	Franklin Research Co., Philadelphia, Pa.
Sodium alcohol sulfate	Avitex SF	E. I. duPont de Nemours & Co., Wilmington, Del.
Tetrafluoroethylene dispersions	Teflon 852-002	E. I. duPont de Nemours & Co., Wilmington, Del.
Polyethylene emulsion	A-C Polyethylene 629 (20% emulsion)	Semet-Solvay Div., Allied Chem. & Dye Corp., Tonawanda, N. Y.
Waterglass (40° to 42° Be sodium silicate)		Mallinckrodt Chemical Works, Philadelphia, Pa.
Alkyl aryl polyethylene glycol	Antarex A-400	General Aniline & Film Corp., New York, N. Y.
Sodium lauryl sulfate	Duponal ME	E. I. duPont de Nemours & Co., Wilmington, Del.

INSTITUTE OF METAL FINISHING

(*Continued from page* 39)

surfacers may be hot-sprayed, and wet-on-wet spraying with a flash-off period is possible. Most of the paints can be baked at 250-350°F. for 20-40 minutes, but care is necessary to drive off water uniformly and more heat is required than for conventional solvent paints.

The resistance to weakening of water-thinned paints is usually good though they are inferior in hardness compared to conventional paints.

The Use of Vinyl Resins in Appliance Finishes

By P. R. Day (Imperial Chemical Industries Ltd. Paints Div.)

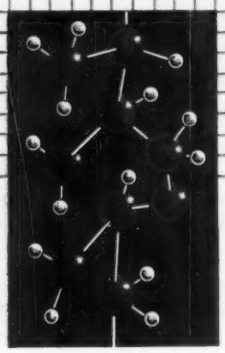
Due to their good resistance to heat, chemical attack, and hydrolysis, resins are in many ways ideal vehicles for use in baking appliance finishes. That until quite recently they have not been used widely for such finishes is due to certain disadvantages, notably their poor application properties and high cost. Today, vinyl polymers are used mainly in cross-linking appliance finishes, a development which facilities the use of higher solids content and cheaper solvents and give better adhesion, solvent resistance, and hardness.

Most widely-used finishes of this type have been acrylic-based enamels and a typical 'all purpose' enamel used on washing machines, driers, refrigerators, and freezers, is applied direct to pretreated steel at a film thickness of 1.6 mil.

An investigation comparing this all-purpose finish (A) with an epoxy system (B), a semi-drying alkyd system (F), and a non-drying alkyd system (D), was carried out for the purpose of which the last three finishes B, C, and D, were applied over a primer.

The acrylic enamal, A, showed the highest hardness and toughness, followed by B, C, and D in that order. In impact resistance and flexibility A was somewhat inferior while, on the Taber Abrasion Tester, finish A was equivalent to finish C, inferior to B, but superior to D.

In its resistance to detergents, soap, alkalies, water, salt spray, grease, heat, and kitchen yellowing stains, the acrylic finish A was somewhat superior to finish B, and a good deal superior to C and D. Apart from replacing other conventional finishes on appliances, the acrylic finishes are also being used as a replacement for porcelain enamels.



SYNTHETIC RESINS

The Backbone of Modern Finishes

A SURVEY OF THE LATEST DEVELOPMENTS IN SYNTHETIC RESINS USED IN COATINGS

Part III - Melamines

By Harold P. Preuss

THE first recorded laboratory manufacture of chemical melamine is credited to Von Liebig, a German chemist, who prepared it in 1834. Although it remained a very rare chemical for over a hundred years, because it could not be synthesized in large quantities at reasonable cost, its reactions with formaldehyde were studied from a laboratory standpoint.

Shortly before World War II, a successful commercial process released melamine from its obscure position and, with many of its fundamental reactions already studied, it required only a short time for a commercial melamaine resin for coating applications to make its appearance. This resin was the forerunner of today's melamine-formaldehyde coating resins.

Manufacture of Melamine

Melamine is a cyclic compound containing nitrogen. As such, it falls under Classification No. 7 (Nitrogen Containing Resins) mentioned in the first article in this series. Melamine is manufactured in several steps:

1. Calcium carbide is made from lime and coke in an electric furnace:

$$3\,C + CaO \xrightarrow{\Delta} CaC_2 + CO\uparrow$$

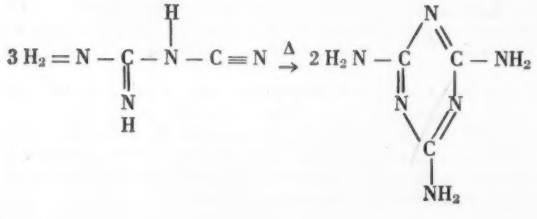
2. Additional heat is next supplied to raise the temperature to 900°C. or higher, at which time the reaction becomes exothermic:

$$CaC_2 + N_2 \rightarrow CaCN_2 + C$$

Fluxes (calcium chloride or fluoride) may be added to increase the reaction rate, or to lower the reaction temperature.

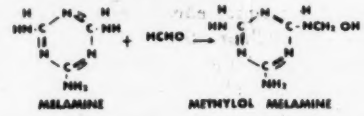
3. Acidification of the calcium cyanamide formed in the above reaction with dilute sulfuric acid or aqueous carbon dioxide produces free cyanamide (H_2CN_2), which in turn dimerizes to form dicyandiamide.

4. Melamine is made by heating dicyandiamide in an autoclave at high temperature in the presence of ammonia:

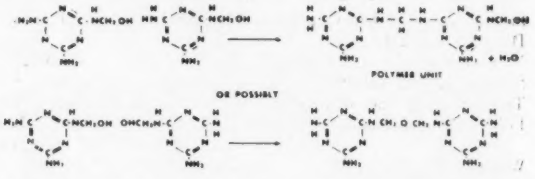


Manufacture of Melamine — Formaldehyde Type Resins

Melamine, as such, is not usable in the resin field. However, when reacted with formaldehyde (HCHO) it forms methylol melamine.

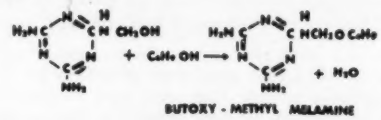


This reaction is shown in its simplest form. Actually there may be four to six molecules of formaldehyde per molecule of melamine. The "polymer unit" would thus appear as follows:



Referring back to the simple formula, methylol melamine may in turn be reacted with an alcohol. If methyl alcohol is used, a resin would be formed which would have poor organic solubility and practically no tolerance for hydrocarbon solvents.

It would have poor compatibility with alkyd resins, but would be extremely fast curing. If ethyl alcohol is used, the resin formed would exhibit fewer of these deficiencies. Cure speed would be reduced. If propyl, isobutyl or normal butyl alcohols are used, optimum properties in solvency and tolerance, compatibility and well-modulated cure are realized. As the chain length of the alcohol increases, it becomes more and more difficult to delay the poly-condensation sufficiently to permit the alcohol to react with the remaining methylol groups. The reaction of methylol melamine with butyl alcohol to form butoxy-methyl melamine is as follows:



This is known as a "butylated" melamine resin. In the case of the "polymer unit" described in the preceding

TABLE I

Resin Properties as a Function of Formulation Changes*

	Viscosity	*Cure*	*Compatibility*	*Solution Stability*	*Mineral Spirit Tolerance*
Formaldehyde *Content*					
High	Low	Slow	Very Good	Excellent	Very Good
Low	High	Fast	Poor	Poor	Poor
Alcohol *Type*					
Long Chain	Low-Med.	Slow	Very Good	Good	Very Good
Short Chain†	Low	Very Fast	Poor	Poor	Poor
Alcohol *Content*					
Maximum	Low	Slow	Excellent	Good	Excellent
Minimum	High	Fast	Poor	Poor	Poor

*Only one variable at a time—pH controlled.
†Frequently leads to popping troubles.
Note: The above data applies equally to both Melamine and Urea type resins (Monsanto).

paragraph, it is probable that three or four methylol groups would be tied up, with the remaining ones open for "butylation."

Cure of Melamine-Formaldehyde Resins

While the mechanism of cure of melamine coating resins has never been firmly proved or elucidated, some concept of these reactions may be given. Cure of melamine resins, by themselves, is actually very sluggish. An extremely small amount of acid is sufficient to rectify this in normal baking ranges (200-450°F.). Cure may take place by splitting out butanol from butoxy groups, formaldehyde from a partial polymer unit, and possibly traces of water from any residual methylol groups. Acid bodies appear to have no catalytic effect on melamine resins at temperatures below about 180°F.

Properties of Melamine-Formaldehyde Resins

The general effects of formulation variables on the final properties of melamine resins are shown in Table I. In this article we will discuss the characteristics of twenty-five melamine type resins made in the United States by the following firms: Monsanto Chemical Company, Plastics Division, in Springfield, Massachusetts; American Cyanamid Company, Plastics and Resins Division with principal offices in New York City; Rohm & Haas Company, Resinous Products Division, in Philadelphia, Pa.; Allied Chemical Corporation, Plastics and Coal Chemicals Division, with main offices in New York City, and Reichhold Chemicals, Inc., White Plains, N. Y. Properties of these resins are summarized in Table II.

Monsanto Resins

The following group of four resins made by Monsanto Chemical Company all have the same general properties of very fast cure, high color retention, limited compatibility with alkyds, limited aliphatic hydrocarbon tolerance, good alkali resistance, and good exterior durability:

Resimene 875 is primarily suited for rapid baking finishes in conjunction with short to medium-short oil length, xylol soluble alkyds of both drying and non-drying types. It finds wide usage in the range of 5 to 40 per cent of the vehicle solids in baking enamels designed to cure on schedules of 200°F. to 450°F. Baking times may be varied from as long as 60 minutes at the lower temperature to as short as a minute or less at the higher one. Finishes containing appreciable amounts of this resin possess a high degree of mar resistance, hold their color well on overbaking, and have good exterior durability.

Resimene 876 is primarily suited for baking finishes where the extremely fast snap cure of Resimene 875 is not of permanent importance. It may be used with the very highest viscosity short oil alkyds with assurance of better package stability. The better mineral spirits tolerance of Resimene 876 makes it more adaptable for use in enamels designed to be reduced with some mineral spirits. Other features obtained are abrasion resistance, color retention, good initial gloss and good exterior durability.

Resimene 878 combines excellent curing properties with good leveling and flow. Roller coat, dip or spray finishes using this resin show excellent leveling properties, and will cure, on longer bake schedules, as hard as a similar finish containing Resimene 875. The excellent stability of Resimene 878 makes it adaptable for fast-baking enamels for general purpose use in which substantial enamel viscosity increase cannot be tolerated. Its exterior weathering features are also good.

Resimene 879 formulated with alkyd resins for baking enamels exhibits exceptionally rapid cure response over a temperature range of 180°F-300°F. It retains, in addition, the good exterior durability, color and retention, and mar resistance characteristics of the other members of the Resimene family. It lends itself particularly well to application in automotive, appliance and most general purpose industrial enamels.

A resin having a somewhat slower cure than the above is sometimes desirable. Such a resin is represented by:

Resimene 877 which is unique in that it shows compatibility with almost all alkyds containing more than 50 per cent oil but is not compatible with those containing appreciably less than that amount. Resimene

TABLE II

PROPERTIES OF MELAMINE COATING RESINS

MFR.	TYPE OF RESIN	% SOLIDS	SOLVENT	COLOR	VISCOSITY Gardner-Holdt 25° C.	ACID NO. (Solids Base)	LBS. per Gal.	SOLVENT TOLERANCE: ASTM Solvent③ K.-B. Value 31-33	Hydrocarbon Minimum⑥	N-Heptane	Mineral Thinner①	Mineral Spirits, %
MONSANTO	Resimene 875	50	25% Butanol 25% Xylol	5④	L-P	Less than 1	8.25-8.35	1.5-4.0				
	Resimene 876	50	40% Butanol 10% Xylol	5④	G-M	Less than 1	8.3-8.4	5.0-10.0				
	Resimene 878	50	35% Butanol 15% Butyl Cellosolve	5④	I-M	Less than 1	8.3-8.4	3.5-7.5				
	Resimene 877	50	25% Butanol 25% Mineral Spirits	5④	I-M	Less than 1	8.0-8.1	25.0-Inf.				
	Resimene 879	50	50% Isobutanol	5④	K-P	Less than 1	8.1-8.4	3.0-6.5				
	Resimene 881	60	20% Butanol 20% Xylol	5④	L-P	Less than 1	8.6-8.7	2.0-4.0				
	Resimene 882	66	34% Xylol	5④	Z-Z4	Less than 1	8.85-8.95	0.5-2.5				
	Resimene 883	60	20% Butyl Cellosolve 20% Mineral Spirits	5④	S-W	Less than 1	8.5-8.6	1.0-3.0				
	Resimene 885	60	40% Butanol	5④	K-Q	Less than 1	8.4-8.6	2.5-6.0				
AMERICAN CYANAMID	Cymel 245-8	50	Butanol Xylol	1⑤	L-O	-	8.3		200 Min.			
	Cymel 243-3	60	Petroleum Aromatic	1⑤	V-Y	-	8.5		300 Min.			
	Cymel 248-8	55	Butanol Xylol	1⑤	N-Q	-	8.4		175 Min.			
	Cymel 247-10	60	Butanol	1⑤	T-W	-	8.4		1000 Min.			
	Cymel 244-10	60	Butanol	1⑤	P-S	0.5 Max.	8.5			350 Min.		
	Beetle 230-8	50	27% Butanol 23% Xylol	1⑤	R-U	0.5-2.0	8.3		150 Min.			
ROHM & HAAS	Uformite MM-46	60	Xylol-Butanol 1:1	Colorless and Clear	I-L	0-2	8.4				50 Min.	
	Uformite MM-47	60	Xylol-Butanol 1:1	Colorless and Clear	P-T	0-1	8.5				35 Min.	
	Uformite MM-55	50	Xylol-Butanol 1:4	Colorless and Clear	F-K	0-2	8.1				40-70	
	Uformite MM-55HV	50	Xylol-Butanol 1:9	Colorless and Clear to slightly hazy	T-X	0-2	8.2				45-85	
	Uformite MM-57	50	Butanol	Colorless and Clear to slightly hazy	G-J	8-12	8.2				50-100	
ALLIED CHEMICAL	Plaskon 3380	50	27% Butanol 23% Xylol	Water White	F-H	0-1②	8.2-8.4					Over 800
	Plaskon 3381	50	30% Butanol 20% Xylol	Water White	M-Q	0-1②	8.3-8.5					Over 500
	Plaskon 3382	55	25% Butanol 20% Xylol	Water White	D-F	0-0.5②	8.3-8.5					Over 500
REICHHOLD	Super-Beckamine 3550-50	48-52	Xylol-Butanol	2⑤ max.	L-P	2 max.	8.25-8.41					200
	Super-Beckamine 3555-60	58-62	Xylol-Butanol	2⑤ max.	S-V	1 max.	3.5-8.7					250

① C.C. tolerated by 10 grams resin solution.
② Solution basis.
③ Tolerated by 1 gram resin solution.
④ By APHA Standards. All lighter than 1 by Hellige Comparator.
⑤ Gardner. 1933. Max.
⑥ Pounds of 76.4% n-Heptane and 23.6% Toluene tolerated by 100 lbs. of resin solution.

877 is ideally suited for dipping enamels, and shows excellent stability in constantly agitated tanks. It is particularly designed to be used with mineral spirits soluble alkyds, and shows excellent gloss and exterior durability in baking finishes with such alkyds for application by spray, dip or roll coat.

Still another group of resins includes four types which are really solutions of the same base resin cut (1) in butanol-xylol mixture to yield Resimene 881, (2) in straight xylol to yield Resimene 882, (3) in mineral spirits-butyl cellosolve mixture to yield Resimene 883, and (4) straight butanol to yield Resimene 885. The base resin has a wide range of compatibility with alkyds, high initial gloss and good gloss retention, better alkali resistance than previous types described and excellent outdoor durability. Details concerning these four resin solutions are as follows:

Resimene 881 has excellent soap resistance, abrasion resistance, and exterior durability. Thus it represents an extremely close approach to a general purpose amino resin. Resimene 881 has an outstanding record of performance in both the automotive enamel and appliance enamel fields.

Resimene 882 is unique in that it contains no active amino resin solvent in its solution. This permits a formulator to select his active solvent from a wide range of alcohols, esters, ketones and cellosolves, without a fixed proportion of butanol being present. Generally speaking, oxygenated solvents are active solvents for amino resins; aromatic hydrocarbons are latent solvents; and aliphatic hydrocarbons are diluents. Resimene 882 should not, however, be used in enamel in which no active amino resin solvent is present. Resimene 882 otherwise has the same film properties attainable with Resimene 881. Its particular value to the formulator is in applications in which butanol is a detriment to solution compatibility, as with vinyl resins of certain types, and in instances in which alcohols in general are undesirable and can be replaced with ketones, cellosolves or esters. Resimene 882, because of its lack of butanol, is ideally suited for applications requiring use of the resin in the form of a water emulsion.

Resimene 883 was designed primarily as an amino resin for roller coating. Since it contains neither butanol nor aromatic hydro-carbon in its solution, enamels may be formulated which have a less pungent odor when used with mineral spirits soluble alkyds. The flow properties are ideal for roller coating applications. Resimene 883 has the same film characteristics associated with Resimenes 881 and 882, namely high gloss, freedom from haze, improved alkali resistance, durability and adhesion, and shows the same wide compatibility range with alkyds.

Resimene 885 has been designed for the formulator who desires the same extremely wide range of alkyd compatibility as Resimene 881 but who also requires improved stability and aliphatic hydrocarbon tolerance. This resin also displays the same level of gloss and gloss retention as Resimene 881 as well as its soap resistance, abrasion resistance, and exterior durability.

American Cyanamid Resins

Melamine type resins made by American Cyanamid are as follows:

Cymel 245-8. This is an alkylated melamine resin. It is supplied in a xylol-butanol solution and is compatible with alkyd resins in xylol solutions. This was the first resin of this type offered to industry.

Cymel 243-3 is a specially processed alkylated melamine-formaldehyde resin. It is processed to have the widest range of compatibility, and is completely compatible not only with short-, medium- and long-oil resins but also with polymerized oils and many oleoresinous varnishes. It is supplied as a substantially butanol-free low odor solution in medium boiling range petroleum aromatic solvent. It has excellent curing speed, gloss, flow and chemical resistance comparable in these respects with Cymel 247-10 (description of which follows). It may be used in formulations for application by roller coat, dip or spray and as a thermosetting fortifier for oils and varnishes.

Cymel 248-8 emphasizes unusually fast cure and resistance to soap and detergents. It shows somewhat broader range compatibility than Cymel 245-8 and and gives enamels with excellent stability. This is a butylated melamine-formaldehyde resin solution and is desirable for many baking applications. It is generally used in alkyd-amino resin enamel formulations in the proportion of 10% to 40% of the vehicle solids. Depending upon the type and amount of alkyd resin used, average baking schedules vary from 10 to 60 minutes at 200° to 350°F. In durable automotive finishes, Cymel 248-8 offers advantages of fastest cure and greater hardness. In typical formulations 10% to 15% Cymel 248-8 is used at bakes of approximately 30 minutes at 250°F. The fast curing characteristics of this resin suggest its use in small amounts in economical baking enamels. Quality appliance finishes, formulated with alkyds, require larger ratios of Cymel 248-8 to provide maximum chemical resistance and color retention.

Cymel 247-10 has a high degree of tolerance for weak solvents, such as mineral thinner, and compatibility with the longer oil resins, without sacrifice in compatibility with the short oil resins. Enamels formulated with this resin have excellent stability and bake to high-gloss finishes. Such enamels usually have excellent flow. This is a butylated melamine-formaldehyde resin, and may be used with both oxidizing and non-oxidizing alkyd resins. Fastest baking times are obtained with oxidizing alkyds. For maximum color retention non-oxidizing alkyds are suggested. The resin ratios and baking schedules may be varied to meet specific requirements. From 10% to 40% melamine resins is the general range used. Baking schedules depend on type of alkyd and ratio of melamine resin but are similar to those described for Cymel 248-8. When used with styrene-alkyd copolymers in baking finishes, Cymel 247-10 contributes improvements in solvent, chemical and mar resistance.

Cymel 244-10. This butylated melamine-formaldehyde resin has exceptionally high tolerance for weak solvents such as mineral thinner. It is supplied as a

solution in butanol to allow for maximum compatibility with other resin solutions. In other respects Cymel 244-10 exhibits the favorable properties of alkylated melamine resins.

Beetle 230-8 is a combination urea-melamine-formaldehyde resin designed to incorporate the qualities of melamine resins with the economy of urea resins. It is used with alkyd resins to produce fast-baking finishes which have outstanding performance. Beetle 230-8, because of its melamine content, will cure at temperatures as low as 200°F. and will have better color and gloss retention than a straight urea resin above 300°F. It is used in the range of 10% to 40% Beetle 230-8 with both oxidizing and non-oxidizing alkyd resins for a wide variety of white and colored baking finishes. These finishes bake at temperatures of 200°F. to 350°F. at time periods of from 10 to 60 minutes depending on the amount of Beetle 230-8 and the type of alkyd resin. For maximum color, as in high-grade white refrigerator enamels, a combination of 25% Beetle 230-8 with 25% of a non-oxidizing alkyd resin, and 50% of an oxidizing alkyd resin (solid resin basis), gives excellent results. This is usually baked for 30 minutes at 300°F. For a general purpose white baking enamel, a combination of 25% Beetle and 320-8 with 75% of the oxidizing alkyd resin, gives outstanding toughness and adhesion. This may be baked for 60 minutes at 250°F., 30 minutes at 275°F. or 20 minutes at 300°F. Finishes made with Beetle 230-8 have excellent mar-proof surfaces. They show outstanding toughness and adhesion and improved water and alkali resistance.

American Cyanamid also supplies a *Catalyst 296-9* which was developed to accelerate the cure of melamine as well as urea resins at normal baking temperatures and to permit the cure of clear finishes and enamels within relatively low temperature ranges. By the use of this catalyst, melamine resin formulations can be cured within the range 150-180°F. and urea resin formulations can be cured as low as 120°F.

Modifications of the Cymel resins by blending with alkyd resins may be made, with good results. Such modified resins, with up to 30% melamine content, offer favorable combinations of such properties as color, gloss, toughness and good adhesion. Styrenated or methylstyrenated alkyd resins are improved as regards mar resistance and solvent resistance by the addition of 5-15% melamine resin.

Rohm & Haas Resins

Five basic resins are manufactured by Rohm & Haas Company. These are:

Uformite MM-46. This resin shows high compatibility with alkyds of short and medium oil length. Many of the short-oil alkyds are extremely high in viscosity and as a result show limited compatibility with many fast-curing nitrogenous resins. Uformite MM-46 provides excellent compatibility and produces brilliantly clear films with excellent gloss. It is substantially equivalent to Uformite MM-55 (description of which follows) as regards resistance to soap and alkali, retention of color, and adhesion. It shows improved stability but produces slightly softer films.

Uformite MM-47 combines fast curing speed with high compatibility with a wide range of alkyds. In addition, it possesses the outstanding resistance properties characteristic of Uformite MM-46 and Uformite MM-55 (description of which follows). Its principal uses are in enamels for automobiles, appliances, and metal furniture.

Uformite MM-55 is a melamine formaldehyde resin. It must be plasticized with alkyd resins, but the proper choice of alkyd has a decided influence on the results secured. Films made from Uformite MM-55 show excellent gloss and retention of gloss. For stove enamels subjected to high temperatures throughout the life of the stove, Uformite MM-55 offers exceptional advantages due to its excellent retention of color under high heat. This resin has also been used in small proportions in pigmented nitrocellulose lacquers and appears to contribute materially to the durability of such coatings. In particular, chalking is reduced and gloss retention is considerably improved after long exterior exposure. For automotive type coatings, these are important advantages.

Uformite MM-55HV is a high-viscosity modification of Uformite MM-55. It retains the fast curing speed and high gloss of standard viscosity Uformite MM-55 but permits the production of baking enamels with lower solids content, thus giving important economies in formation. It is suggested for use as a general-purpose melamine-formaldyhyde resin in white industrial baking enamels for application to refrigerators, kitchen cabinets, hospital equipment, metal signs, and automobiles. In such formulations, excellent hardness, gloss, color and retention of color, adhesion, and resistance to alkaline cleaning agents are obtained.

Uformite MM-57 has outstanding advantages of gloss, speed of cure, and resistance to soaps and detergents. It is recommended for all of the applications in which melamine-alkyd systems have been used previously. Gloss values as high as 90, measured on a 60° Glossmeter, are readily attained in white baking enamels made with 30 parts of Uformite MM-57 and 70 parts Duraplex ND-77B, a Rohm & Haas non-oxidizing phthalic alkyd resin.

Allied Chemical Resins

Melamine resins made by Allied Chemical Corporation are as follows:

Plaskon 3380 demonstrates superior flexibility and adhesion as well as excellent gloss and gloss retention. Formulating versatility is possible due to its extremely high mineral spirits tolerance.

Plaskon 3381 has a rapid cure rate, outstanding gloss, gloss retention and heavy-duty resistance to weathering, soap, detergents, acids, alkalies and household stains. It is ideal for formulating rugged coatings for automobiles, refrigerators, washing machines and appliances.

Plaskon 3382 is a specially designed melamine resin for automotive formulations where rapid cure rate, excellent gloss retention, and wide compatibility with alkyd resins are required. It has outstanding freedom from pitting and cratering. Because of its

(*Continued on page* 63)

Versatility — A Necessity in Efficient Custom Painting

By Walter Rudolph

MOST folks in the finishing business are content to solve one problem and keep one painting operation going successfully. So, when Cooper Industries, of Canfield, Ohio, states, "We paint anything — any time, any quantity," the reader may become somewhat suspicious. Nevertheless, this has been company policy.

Reed R. Cooper, founder and president of the firm, looks back upon a decade of painting everything from a fractional-ounce fitting to today's structural steel components, weighing hundreds of pounds. Certainly you can't step into the plant and find paint flying and conveyors humming at any moment, any day — but the arresting and interesting fact is that one might find these conditions on the very next day.

Anyone who knows painting in today's market, where quality and production are increasingly vital, realizes that painting needs specialized attention or handling. Clinton T. Cooper, graduate engineer and vice president of the company, points to the following factors which warrant the existence of his custom painting shop:

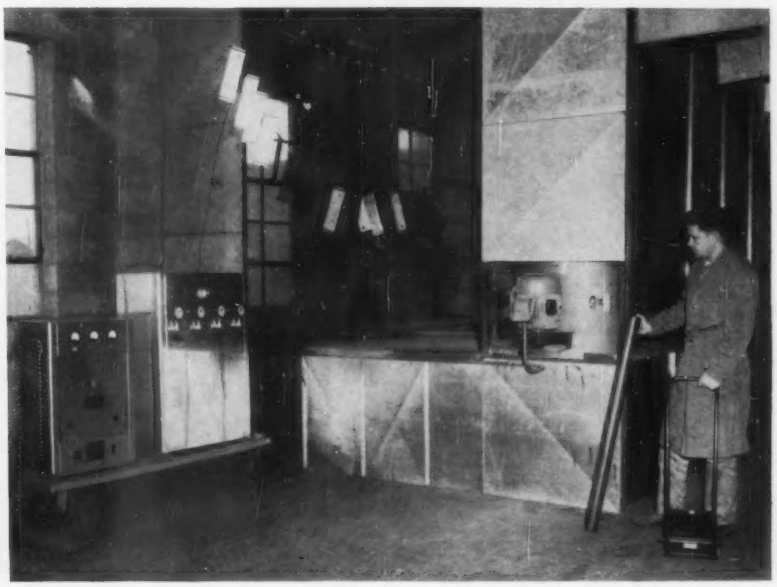
In a manufacturing plant, cleaning, painting, and packaging of products necessitates (1) services of valuable personnel which should or could be used in other channels; (2) a large investment for equipment in use only part time; (3) valuable manufacturing space also in use only part time; (4) adherence to state boards with periodic inspections; (5) increased fire hazards and insurance rates.

It appears that a description and discussion of this firm's physical layout and facilities would be most interesting to readers, granted that a knowledge of finishes, viscosity, surface preparation, temperatures, etc. etc., can be foregone. As we see it, the plant and its equipment make possible the most versatile yet automatic processing of products and components.

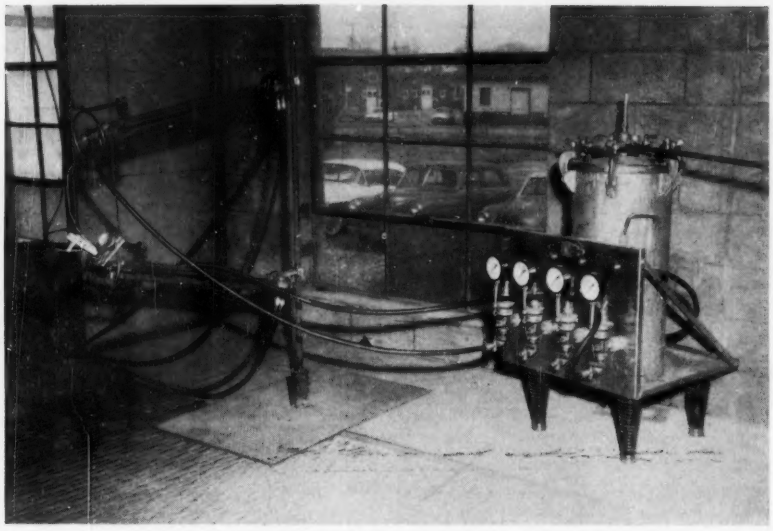
Only recently the company installed a giant baking oven which increased the floor area to 14,000 square feet. Several other additions have been made since 1953. Perhaps a quick listing of facilities would help here:

This compact plant includes covered shipping and receiving docks; fork trucks and wide-bay cranes of multi-ton capacity; about one-half of the plant is served by a cable conveyor 400 feet in length; another large section of the plant, adjacent to the new oven, has a versatile conveyor for turning, changing different levels, and passing through a spray or electrostatic paint booth and then through the oven.

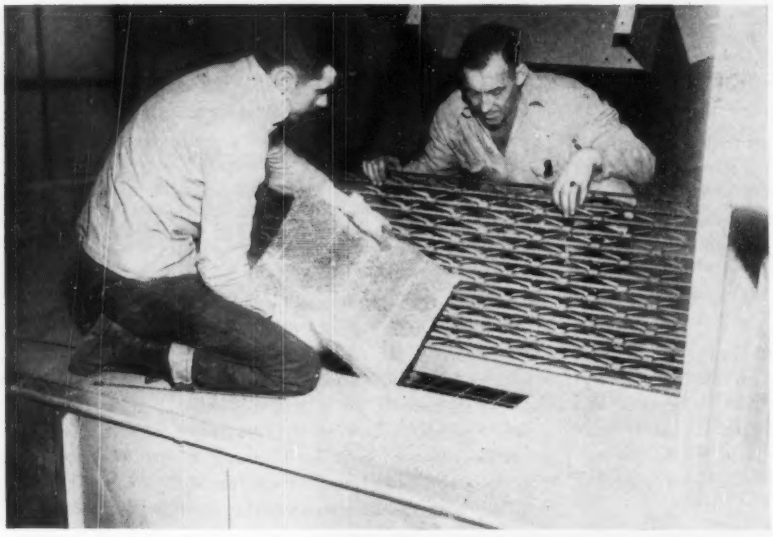
Continuing, there are smaller facilities for "smaller"



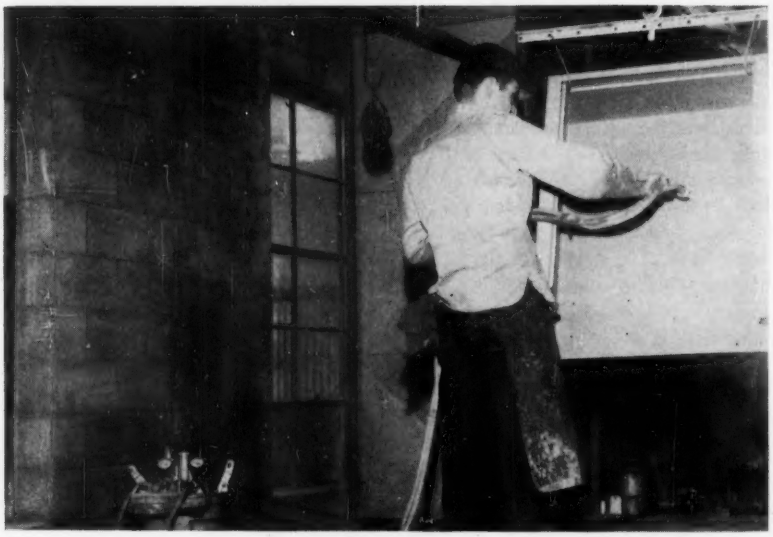
The post and hand cart, shown by Clinton Cooper, are among items electrostatically painted in this custom built spray booth.



Inside special booth, gauges, controls and paint tank for electrostatic work, along with spray guns and parts.



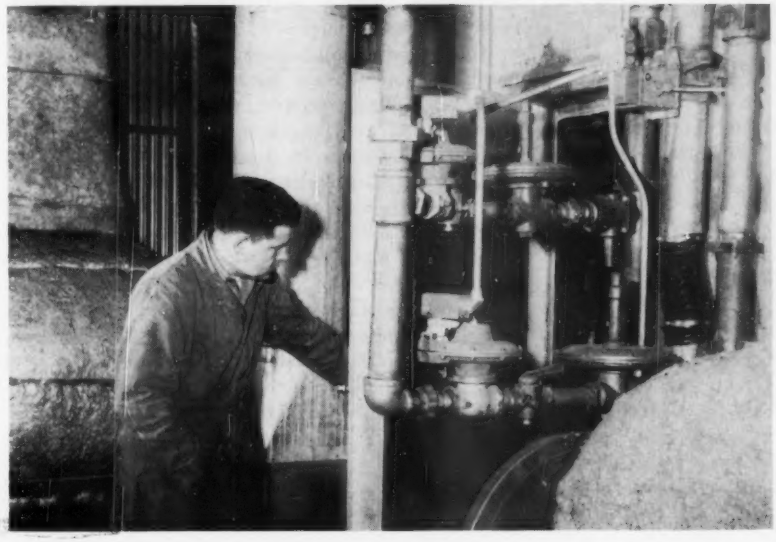
This shows how floor grating may be raised from the booth plenum floor for replacement of soiled arrestors.



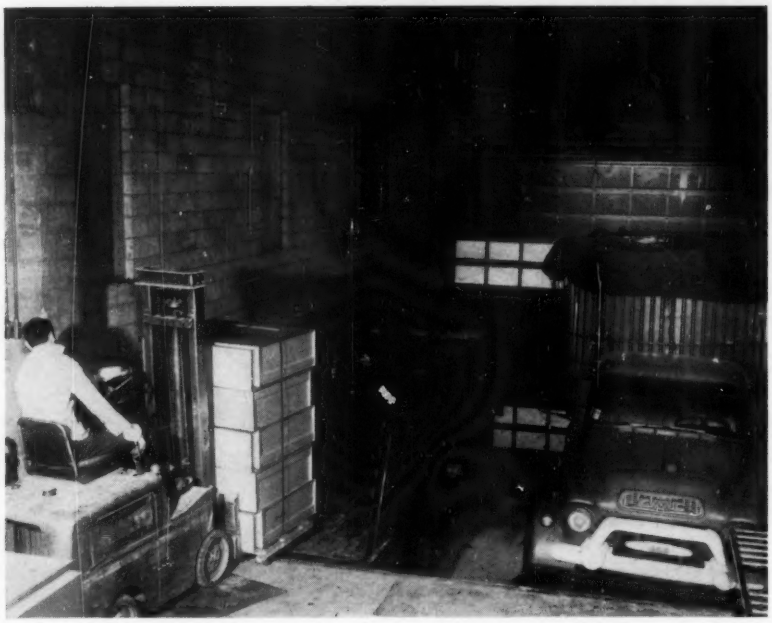
In a matter of minutes, Cooper can switch to job calling for spray painting in this booth.

Masking cabinets prior to trip through spray booth. This conveyor supplements the cable conveyor in this custom plant.

Cooper had precision controls specified for his radiant-convection oven, for quick job-switching.



Safety or work-inspection door in big new oven at Cooper Industries. Note insulated blowers.



Covered receiving and shipping area is important for fast handling of custom work of all kinds. Fork industrial truck (left) speeds loading.

parts; power washing and degreasing are available; packaging and strapping equipment is on hand; three trucks are owned for pickup and delivery. Many other finishing details, of comparatively minor moment, can be taken care of here. The organization also does metal perforating, slotting and other fabrication on some structural channel steel of from 10 to 26 feet in length.

The channel cleaning and painting work is done in the portion of the plant first mentioned, with hundreds of feet of cable conveyor overhead. If required, these long channels go directly from the receiving dock to a power press for slotting or other fabricating processes. In the same line are long cleaning and phosphating tanks. Parts are lowered and raised from these tanks with air-powered hoists.

Cables are so placed that their passage from receiving to packaging and shipping, and return to the cleaning stage enables accommodation of the heavy channels of varied lengths. An important factor is that conveyor speed and loading can be adapted to the situation at hand.

Versatility is vital to custom painting. Design of the conveying system and racks or hangers holding parts dovetails with the drying times required by the paints involved as well as the sizes of channels to the speed of the cable conveyor. The contractor must engineer the painting job to do it the best way it can be done with quality finishing as the prime consideration.

In the plant section devoted to spray, electrostatic, flow and dip coating of parts or items other than channels, the firm installed a specially built booth. This booth is a sort of "room" raised from the plant floor. The booth is 10 feet by 20 feet and is about a yard above floor level. A grated opening in the booth flooring permits air to be drawn into a plenum over which all work is done.

Spraying or electrostatic coating can be done on either side of the grating. Fans at opposite corners of the booth draw or recirculate air at about 36,000 cfm, through the plenum. As the air passes through the grating, carrying fumes and overspray, it hits paint arresters or filter pads, supported by a steel framework designed and erected by Cooper Industries. These pads are discarded as dictated by the work flow or use of the booth. Roof dampers tied into this recirculating air system allow exhausting of air as circumstances require.

In the matter of the recently added oven, we again find that custom painting requirements were given careful consideration. The firm formerly has used, and still does use, heating lamps of various kinds for paint baking. But in the interest of greatest versatility, more satisfactory baking of painted objects as well as with time and money-saving considerations, the radiant-convection baking oven won out.

Cooper had even engineered the oven he wanted and was ready to build it when he learned that an established firm in the business of making ovens could do a better job at a lower cost. Even with the installation of a lengthy gas line with which to fire this oven, the company finds that it was an intelligent investment.

Not only does the oven have precision, instant-acting controls so important to custom painting requirements, but its fast warmup and thoroughly consistent heat make it invaluable. Controls can vary the heat from 220°F. to 350°F. with excellent accuracy.

FINISHING POINTERS

Silver Plating of Electrical Contacts by Immersion*

By Isidore Geld

Supervisory Chemist, Naval Material Laboratory, New York Naval Shipyard

MANY types of brass and copper electrical contacts are silver plated in order to increase conductivity. Contacts used in specialized instrumentation are usually silver plated on a custom basis, where suitable commercially plated contacts are not available. If electroplating is inconvenient, contacts are often immersed, at room temperature, in a silver cyanide solution,[1] or rubbed with a silver-plating powder.[2] Although uniform, the flash plating produced by immersion is extremely thin (usually less than 0.005 mil) and does not become appreciably thicker with longer immersion time. The plating powder produces a thicker coating (building up to approximately 0.05 mil), but only at the expenditure of considerable effort in at least ten replicate applications; furthermore, plating of recesses and internal areas is impractical by this technique.

To overcome these deficiencies, an immersion procedure was developed for copper and brass contacts, which produces a considerably thicker plating in a short time. The formula for the plating solution is based on that used by Rama Char and Sadagopachari for electroplating of silver in a cyanide-free bath.[3] The proposed procedure is as follows:

Surface conditioning:

The brass or copper contact (free of dirt or grease) is dipped for 15 to 30 seconds at room temperature into an acid bright-dip of the following composition:

Hydrochloric acid	2 ml.
Nitric acid	72 "
Sulfuric acid	435 "
Water	491 "

Plating:

The contact is immediately rinsed with water and immersed in a hot solution of the following composition:

Silver nitrate	50 g./l.
Potassium iodide	500 "

Plating thickness increases with time and temperature as shown below:

Temp. °C	Thickness mil 15-Minutes	30-Minutes	60-Minutes
30	0.05	.....	.....
50	0.07	.....	.....
70	0.15	.....	.....
80	0.20	.....	.....
100	0.27	0.38	0.50

For electrical contacts, a 15-minute immersion at 100°C. will give an adequate thickness. Government specifications for silver-plated contacts generally require a minimum thickness of 0.2 mil. Of the common metals and alloys, only copper and brass can be plated by this procedure.

The plating is of uniform thickness and evenly distributed over inner and outer surfaces. It is mat white in appearance, and can easily be polished.

Although exhibiting good adhesion, the silver deposit is somewhat porous and may not protect the basis metal from corrosion. The porosity, however, has not been found to adversely affect usefulness of the deposit on contacts. The process has been used in the Material Laboratory for many complex contact surfaces with considerable success.

**The opinions or assertions contained in this paper are the private ones of the author and are not to be construed as official or reflecting the views of the Naval Service at large.*

References

1. "Metal Finishing Guidebook," p. 454, Metals and Plastics Publications, Inc., 28th Edition, Westwood, N. J., 1960.
2. H. Bennett, "The Chemical Formulary," Vol. IV, p. 397, Chemical Rubber Publishing Co., 2nd Edition, New York, 1940.
3. T. L. Rama Char and R. Sadagopachari, "Electrodeposition of Metals and Alloys from Cyanide-Free Baths I. Silver from Iodide Solutions," Current Science (India) **19**, 284 (1950).

Correction

On page 51 of the June issue, in the article dealing with gold deposits, it is stated that the penetration depth of the Knoop indentor is one-thirteenth of the longer diagonal. The correct reading of the number should be one-thirtieth.

Precise Barrel Finishing

By Ralph F. Enyedy, *Westinghouse Electric Corp., Electronic Tube Division, Elmira, N. Y.*

This is Part II of the series on barrel finishing. Part I appeared in the July issue.—*Ed.*

Removing Interior Burrs

Referring back to the abovementioned brackets, and their treatment with 1″ abrasive chips, it can be seen that parts of the brackets would not be reached by the media. The interior part of the bend, having a smaller radius than 1″, would be untouched, as would be the insides of the holes in the parts. (Fig. 9)

To finish within the formed angle of the brackets, as well as within relatively accessible places on other parts, several expedients are practical:

(1) Small chips which approximate the inside radius of the brackets will afford contact everywhere on the parts' surfaces. In such a case, care in selection of the size of chips is necessary to prevent clogging the ¼″ holes. If burrs in the holes were not of consequence, choice of a chip size somewhat larger than ¼″ would be indicated. However, to work within the holes, chips smaller than the hole diameters would be required. It should be borne in mind, that ⅛″ chips could combine to clog holes. Perversely, it seems, any combination which can cause clogging occurs sometime in a tumbling cycle. The largest size medium which can be passed freely through a hole is probably the most practical.

Fig. 9.

Small chips cut less aggressively than larger chips, so extended tumbling times can be expected, to achieve the same results as would be the case with the use of larger chips.

(2) A mixture of 1″ chips and, perhaps, $\frac{3}{16}$″ chips would provide the rapid cutting of larger media together with the penetration ability of the smaller media. This method is often used, but consideration must be given to the screening necessary to assure proper size of the smaller chips, initially, and separation of the two chip sizes after processing is done.

(3) Abrasive forms, molded into accurately shaped and sized media, provide a precise method of gaining rapid action, as well as penetration to hard-to-get-at places. Consider an abrasive form such as that shown in Fig. 10. The triangular shape presents points which reach burrs well within the holes of parts, contact inner radii and, at the same time, have a large individual mass capable of results expected with large chips.

(4) Removal of burrs or roughened surfaces within holes in parts, or inside sleeves and like parts, can be accomplished by using metal forms made of unhardened steel or zinc, for instance. Being "soft," they are capable of becoming impregnated with grit (when used with abrasive compounds) and acting as small files to grind in remote places. A typical routine for use of metal forms is presented a little later.

(5) When processing relatively soft parts, it is well to consider media which has resilience or "give" so that impingement is not so likely, as would be possible with very hard media. Typical soft, but none the less active media are "rubber" and hardwood forms. The former are composed of abrasive grains bonded with rubber or a similar compound, and shaped into

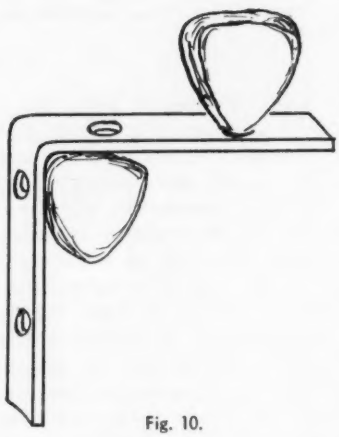


Fig. 10.

forms designed for definite applications. Hardwood pegs can be used with abrasives (emery, pumice, crèmes for plastics) with which they become "loaded" and act much like the metal forms mentioned in (4).

Grinding with Soft Metal Forms

A difficult burr-removal problem often is presented with parts such as sleeves, hubs, etc., which have cutoff burrs pushed into their inside diameters by the cutoff or forming tools of "automatics" or lathes. The usual applications of such parts is such that no vestiges of burrs are allowable within the I.D.'s. This condition offers problems not only in tumbling, but also when other burr removal methods are used. Countersinking usually must be followed by reaming if tolerances are ±0.0005″ or even ±0.001″.

Barrel finishing with soft metal forms has been found successful in very many cases to completely remove the cutoff burrs, thus eliminating the individual handling of the parts. Let us presume the sleeve in Fig. 11 to be 0.290″ steel tubing with 0.015″ wall thickness, unhardened. That would mean the I.D. is 0.260″. We could use $\frac{3}{16}$″ diameter zinc polishapes (football-shaped forms) or $\frac{3}{16}$″ diameter rods about ¼″ long for the media. A long-

cycle abrasive compound would be required because aggressive cutting for a considerable time is necessary in this application. A typical routine is:

1. Rinse out a rubber-lined, 16″ diam. x 8″ wide, horizontal barrel, and rotate to move the opening upward.

2. Pour in about 3,000 parts.

3. Dump in $\frac{3}{16}$″ soft steel diagonals (rods), about 3 volumes of diagonals to 1 volume of the parts.

4. Run in water to a level just under the top of the load (about 1 gallon).

5. Measure in 1 lb. of a long-cycle abrasive compound.

6. Close the barrel, making sure pressure relieving devices are working, and turn on the barrel.

7. Let run at a speed of 35 rpm for 8 hours.

8. Turn off the barrel *and relieve pressures entirely.**

9. With mouth of barrel upward, remove the solid cover and replace it with a perforated cover.

10. Turn on the barrel and allow the liquids to slosh out. Let drain, mouth downward, for a few seconds after turning off.

11. With mouth upward, fill the barrel to overflowing and then, with the perforated door in place, again turn on the barrel and allow liquids to escape. Turn off barrel as before.

12. With the barrel opening upward, remove the perforated door, and run in water to a level about 1″ over the load.

13. Introduce about 4 oz. of a cleaning compound, seal the barrel, and run for about 1 hour.

14. Uncover the barrel and unload the parts and diagonals into wire mesh baskets.

15. Rinse the parts and media well in a hot water rinse tank.

16. Dump the parts and diagonals in a centrifugal dryer and dry both completely.

17. Separate parts from media by use of a shaker screen (¼″ mesh).

Burnishing in Barrels

Polishing, by barrel methods, is carried on in several ways to arrive at varying degrees of "color" or finish, from barely smooth to highly lustrous. Use of polishing (lubricating) compounds with grinding-chips as media is one way of bringing up color. Another is the use of natural stone material (which has less grinding ability) as the media, combined with polishing compounds. A third method of arriving at a more refined finish is to grind in steps, with successively finer abrasives. And, a fourth way is to tumble parts with media entirely incapable of cutting, together with a polishing agent, thereby causing rubbing of surfaces to mold down and otherwise actually move metal (or other materials), to lower projections, and close-up furrows or pits. Very satisfactory "polishes" can be provided by the above processes, especially since advancements in polishing compounds have become so numerous. But, these finishes are not of the type generally thought of as "burnished."

Fig. 11.

Burnishing is processing of parts to promote a very high, *glass-like* finish. It can be established usually, only on parts which are very hard throughout, or are case hardened. What is more, actual burnishing cycles remove no metal at all but depend on rubbing with other parts (in self-burnishing) or with very hard burnishing media such as balls, grain-like forms, pins, and other forms, to attain the wanted glassy surfaces. It is quite important that the media itself be extremely bright in order to achieve a burnished finish on the parts.

Barrels used for burnishing should be lined, either with rock maple, rubber, or neoprene, or with recently developed plastic materials. Needless to say, wood-lined barrels which have been used previously for grinding are not acceptable for burnishing. Furthermore, even with rubber, neoprene, or plastic lined barrels any imbedded abrasive can damage irreparably parts being burnished. Barrels should be entirely clean before introduction of loads for burnishing.

Fig. 12.

Often, hardened parts require preliminary operations before being suitable for burnishing. The part shown in Fig. 12 must have edges completely rounded, and requires an intermediate finishing grind before attempting to burnish. Although edge-rounding, in some cases, should be done before parts are hardened, let us assume for this example that all barrel finishing must be done after case hardening. Then, the routines for complete finishing can be presented thus:

A. Grind To Round Edges

1. Thoroughly rinse out a 30″ x 30″ horizontal barrel and jog to move the opening into position for loading.

2. Into a hoist pan, load 10,000 parts and 500 lb. of mixed (¼″ to ¾″) aluminum oxide-bonded chips.

3. By means of a hoist, load the parts and media into the barrel.

4. Run in water to a level 2″ over the mass.

5. Add a chip compound, about 2 oz. per gallon of water.

6. Seal the barrel, set the speed at 15 rpm, turn on the barrel, and let it run 24 to 36 hours (check radii after 24 hours).

7. Rinse as previously described for other routines above, and unload.

8. Separate parts from chips with a magnetic separator.

B. Grind To Refine Finishes

1. Rinse out a medium size iron tilt barrel, and raise the tilt to an angle about 35° to 40° above the horizontal.

2. Pour in the 10,000 parts.

3. Run in water to a level just under the top of the mass.

4. Measure in a short cycle abrasive compound (1 lb. per gallon of water).

5. Turn on the barrel and let it run 1 hour.

6. Clean and rinse the parts as described in a previous routine, and dump the parts itno a wire mesh basket. Drying is unnecessary if transfer to the succeeding barrel is immediate.

C. Burnish

1. Dump the parts into a rock-maple-lined burnishing barrel (8″ wide x 30″ diameter, inside).

2. Pour in 300 lb. of $\frac{1}{16}$″ burnishing balls.

3. Run in water to a level to the top of the mass.

*Long tumbling cycles can generate some heat within the barrel. In addition, chemical reactions with some compounds and metals cause pressure buildup. A sealed barrel should always be equipped with positive means of relieving pressures, and a barrel should never be opened until all pressures are spent.

4. Measure in 6 oz. of a burnishing compound.

5. Seal the barrel, turn it on, and run it at 15 rpm for about 20 hours.

6. Stop the barrel with the opening upward. Remove the sealing door and attach a screening door.

7. Rotate the barrel to move the opening downward, and allow the liquids to run out. Rotate so that the opening is again at the top. (Compound still protects the parts.)

D. CLEAN

1. Remove the screening door and run in water to the top of the mass.

2. Introduce 3 oz. of burnishing compound.

3. Seal the barrel, turn it on, and let it run for ½ hour. Turn off the barrel.

E. SEPARATE

1. With the barrel's mouth upward, remove the cover.

2. Slowly rotate the barrel to lower its mouth and allow the parts and media to pour out onto a ¼" mesh screen.

3. With a hose, thoroughly rinse out the suds and any parts and media remaining in the barrel.

4. Carefully, to prevent scratching, move the parts from the screen to wire mesh baskets. Dip the baskets in a hot water rinse tank.

F. DRY

1. Pour dry hardwood sawdust into a drying barrel.

2. Introduce parts and sawdust layers successively. Sawdust should cover parts completely.

3. Run the barrel at about 20 rpm for 15 minutes.

4. Unload carefully on a screen.

By no means should the foregoing be considered the complete story of precise barrel finishing. Instead, examples of some of the more common practices have been illustrated to demonstrate processes in a general way. The following descriptions of compounds, equipment, media, and their applications, will provoke thought, it is hoped, on further exploitation of methods to achieve definite results.

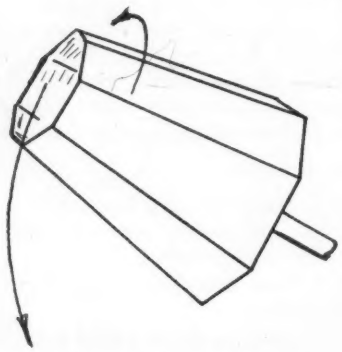


Fig. 13. Tilt-type or oblique barrel.

Barrel Types

OBLIQUE OR TILT-TYPE BARRELS:

These have done yeoman service, in tumbling applications, for decades. They still have a place in the most modern tumbling rooms in that, for certain applications, they are capable of excellent results. Chief advantages of tilt-type barrel machines (Fig. 13) are their ready accessibility for observation of parts' processing, moderate initial and repair costs, complete lack of pressure-buildup while running (in uncovered types), and quick loading and unloading capabilities.

Manufacturers of oblique barrel machines have kept pace with modern trends so that equipment is available with variable speed facilities, Neoprene or other linings, push-button raising and lowering means, and easily maintained and cleaned mounting pedestals.

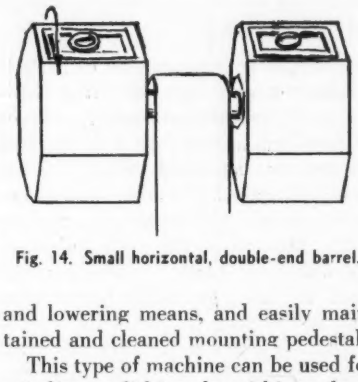


Fig. 14. Small horizontal, double-end barrel.

This type of machine can be used for grinding, polishing, burnishing, cleaning, descaling, drying, and degreasing operations. But there are some limitations in the use of tilt-type barrels in precise barrel finishing. As discussed before, some parts have a tendency to move out of the moving mass in the running barrel, to cluster toward the barrel's mouth. Thorough rinsing out of full barrels between successive finishing steps is difficult in that, when barrels are tilted downward to allow fluids to flow out, parts and media can spill out.

Bottle barrels, mounted on tilt-type machines, can simulate horizontal barrel action, and can be equipped with covers to seal their mouths. By their use some accessibility is sacrificed and, often, machines are not equipped to lower barrel mouths far enough to empty them easily.

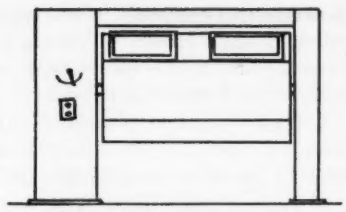


Fig. 15. Large horizontal barrel, two-section type.

Barrels, for oblique-type machines, can be procured of iron, welded steel plate, and of wood. The two former are used generally for grinding purposes, while the last is pretty much confined to polishing work. In addition, special sawdust tumbling barrels can be purchased with steam or electrical heating provisions so that moisture absorbed by the sawdust or corncob material, during the parts-drying, can be driven off, making reuse of the drying material more practical.

HORIZONTAL BARREL MACHINES:

These are available in a large variety of sizes. The action promoted within them makes them adaptable for almost any kind of barrel finishing. Providing loads are suitable, as defined in previous paragraphs, a constant waterfall action takes place within the rotating "drum," giving intimate contact piece-to-piece, or piece-to-media. All parts receive exactly the same treatment, and none can isolate itself from the load.

Small horizontally rotated barrels are excellent for processing small parts such as those produced on automatics. Extremely heavy media such as the $\frac{3}{16}$" soft steel diagonals mentioned in an above example, for working into recesses and confines of small parts, would constitute tremendous loads in large barrels. Use of 8" by 16" diameter barrels in such cases often allows processing of several thousand parts without excessive weight problems. Even smaller barrels can be indicated where very small lots are tumbled. Many sizes of small horizontal barrels are available, including bench types, and a wide choice of arrangements (singly or multiply mounted) can be had (Fig. 14). Machines can be procured with variable speeds, linings, screening facilities, and special loading and unloading attachments.

Large horizontal barrel machines (Fig. 15) can be purchased with barrel diameters from 22" upward. They

are designed for tumbling large loads, of course, so loading and unloading is usually accomplished by the use of hoist pans. With large barrels no rotating by hand to move the opening into position is practical, for instance, so jogging devices are usually specified. Linings of neoprene or rubber, and of hard woods are available and should be considered strongly. Rubber or neoprene linings withstand wear well, and so cause less frequent downtime for barrel replacement. Wood linings can be replaced, usually without removal of barrels from the machine, but they reduce interior dimensions of barrels somewhat, and should be kept wet (in wet tumbling applications) even when not in use. Variable speed arrangements are a prerequisite with large barrels except in situations where only one product is ever tumbled in the individual machine. Pressure relieving devices should never be absent from such barrels. Proper guarding of moving parts on the machine (including the rotating barrel) is demanded in some localities.

BURNISHING BARRELS:

These are generally thought of as heavily built horizontal machines lined with rock maple, and having diameters of 24″ to 30″, and widths from 8″ to 16″ (Fig. 16). They are usually reserved exclusively for ball burnishing, since presence of anything other than burnishing media and burnishing compounds within the barrel can be detrimental in attaining the finishes associated with "burnishing." They are constructed to carry the great weight of burnishing media, and especially designed to produce heavy pressures within the mass — thus their high narrow form. Although other horizontal type barrels are used for burnishing, the "vertical" barrel described, here, has been accepted for years for ball burnishing applications.

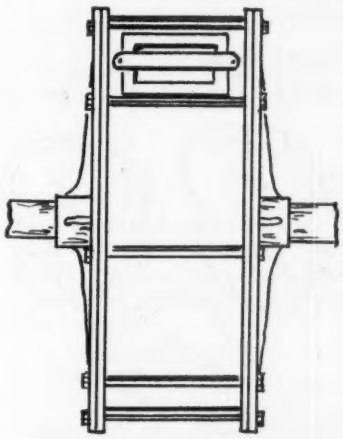


Fig. 16. Burnishing barrel.

Any barrel used for rolling such heavily concentrated loads should be so constructed that some kind of screening hoist pan can be placed between the legs and under the barrel for convenient unloading.

TRIPLE-ACTION BARREL:

This barrel is designed for very rapid, intense "cutting-down" action. Its unique construction utilizes not only the waterfall effect produced in all horizontal barrels, but also a folding-in action promoted by the sloping sides of the barrel (Fig. 17). The rapidity of cutting with a triple action barrel generates heat and pressure within the container. Therefore, it is necessary that pressure-relieving devices be provided, and strict attention paid to their operation when barrels are unloaded.

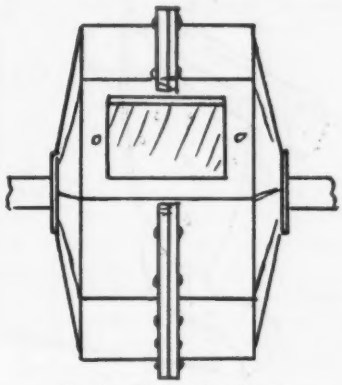


Fig. 17. Triple action barrel.

SUBMERGED BARRELS:

These are similar to the perforated equipment used in barrel plating work (Fig. 18). For tumbling operations, parts and media are loaded into the barrel, which is lowered into a tank, or succession of tanks, and rotated. The advantage of an in-line arrangement is quite apparent; a loaded barrel can be hoisted and lowered from tank to tank containing in order, let us say, a chip-grinding solution, a cleaning solution, and a polishing solution. Parts and media, once introduced in the barrel, remain within the container until fully processed, and can be removed after parts are fully finished.

OTHER HORIZONTAL BARRELS:

These designs include: small drums which can be manually placed on rotating shafts, an application similar to ball mill operations (Fig. 19); compartmented barrels with vertical dividers which allow isolated tumbling of several large parts in the same barrel, but with each piece tumbling within its own compartment; and, fixture accommodating barrels which allow introduction of fixtured parts, the fixtures being capable of moving in the same direction or contra to the rotation of the barrel. The last two types are nearly always designed for specific applications. Manufacturers' recommendations should be solicited for design of such equipment.

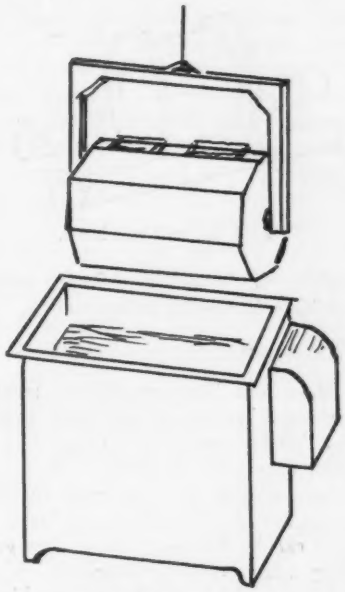


Fig. 18. Submerged barrel.

THE MULTIBARREL:

This is a departure from conventional designs of tumbling equipment. It is, over-simplified, a revolving, vertically mounted disc upon which can be attached many individual barrels (Fig. 20). Placed 90° to the disc, an attached barrel will act much as a small horizontal barrel since, as the disc revolves, so will the barrel roll one full revolution with each revolution of the disc. However, when barrels are mounted at an angle to the disc, a figure 8 action takes place within the barrel.

Individual barrels are comparatively long but small in diameter. Their structure makes possible good deburring of long shafts, racks, and parts which could easily bend in conventional barrels.

The disc is capable of holding very many barrels of various sizes. They can be attached or detached quickly. Tumbling of very delicate and unusually-shaped parts is possible with the

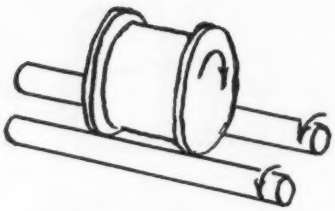


Fig. 19. Ball mill type barrel.

multibarrel, as well as ordinary parts requiring horizontal barrel rolling.

VIBRATING-ROLLING BARRELS:

These look like conventional, large, horizontal barrels, and act in the same way, but have an added feature — vibration applied to the barrel. Vibration alone can rotate parts and media within the barrel so that large, or fragile, parts can be finished without damage. Many parts which ordinarily require racking methods for barrel finishing can be worked freely by the vibration principle.

Combining slow rotation of the barrel with vibration promotes constant change of location of parts and media. Very high loads are finished well by the method, allowing finishing of a large volume of parts in one load.

CONTINUAL TUMBLING AND MATERIAL RETURN BARRELS:

These allow introduction of batches of work from hoppers, tumbling of the batches with media, expulsion of finished parts, and return of media to the tumbling chamber by push-button and automatic means. Approaches to automation are possible with this type of equipment, as well as with applications of submerged barrel equipment.

Departures from "barrel"-finishing are worth mention at this point because, although they cannot be called barrel methods, nevertheless they do employ media associated with, and give finishes similar to, barrel finishing.

One type of machine rotates fixtured parts in a slurry containing abrasives to deburr and otherwise finish the parts.

The other type considered worthy of mention is a vibrated tank or vat containing media into which parts are introduced to undergo finishing treatment.

Media Used in Barrel Finishing

In precise barrel finishing all the various shapes, sizes, and kinds of media are called on. They are "massive" as compared to granular substances such as abrasive grains, sawdust, or ground materials of many types, described later.

Media are used for building up mass of loads, reaching into recesses, adding weight to loads, and for performing their own distinctive functions, not easily attained by other means. Some are natural materials, others are manufactured. All have their particular applications.

CHIPS:

"Chips" is a common name applied to stone-like media used for grinding or polishing. Some of the natural, mined chips such as granite, flint, and

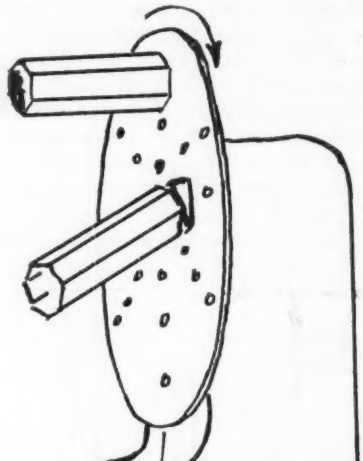


Fig. 20. Multibarrel.

hard Arkansas stone (Fig. 21) are extremely useful for honing to grind moderately on hard metals, or for fairly aggressive grinding of softer metals. When used with lubricating compounds they successfully aid in polishing most types of metal parts. Quite generally the rapidly, aggressively cutting chips are manufactured products such as aluminum oxide grains bonded with hard, tough, ceramic-like materials.

Chips are crushed and screened into a wide range of sizes. Sizes are designated, usually, wtih dual numbers; for example, $\frac{1}{2}$" x $\frac{5}{16}$". The larger number specifies mesh size through which the media will pass, while the smaller number indicates mesh size which will retain the media.

FORMED ABRASIVES:

These are bonded abrasive grains formed into balls, triangles, cones, short rods — shapes which are entirely uniform and, therefore, are dependable so far as predicting their action is concerned (Fig. 22). Although usually more expensive than equal volumes of most chips, their uniformity is an advantage in preventing lodging in parts and in reaching to definite areas of parts. Like chips and other media, larger sizes cut faster, while smaller sizes act less rapidly but produce finer finishes. In this classification, also, fall formed ceramic media which are very hard and precisely shaped. Finishes, by their use, can be very bright. They are sometimes used for finishing plastic parts. Tumbling shapes of sintered metal deserve mention here, too. Well controlled sizes and forms of sintered metal can be used for grinding and burnishing.

"Rubber" Forms (so called) are abrasive grains bonded with neoprene and molded into precise shapes. They are especially suitable for cutting fragile or soft parts, due to their resilience and moderate density.

BURNISHING SHAPES:

These are hardened steel forms, especially made for ball-burnishing applications. They are polished to a glass-like finish. Available, in addition to conventional ball types, are football-shaped forms, pins, diagonals, and a special design best described as ball-cones (Fig. 23). The forms are varied as described above to allow working into all corners or recesses of parts and, furthermore, are obtainable in several sizes each. It should be said here that substitution of bearing balls or other hardened "pick up" forms for ball burnishing can be dangerous, since fracturing of a single form in a burnishing load can damage parts irreparably.

LOADING MEDIA:

Media which load-up with abrasives

Fig. 21. Chips.

Fig. 22. Formed abrasives.

to cut similarly to chips are made of comparatively soft materials such as unhardened steel, zinc, and hard woods (Fig. 24). As touched on before, they are used with abrasive grains with which they become impregnated on their surfaces (loaded). The surfaces so impregnated present grinding areas which work against areas of the parts being processed.

One of the advantages of loaded forms is their ability to wear uniformly, without any fracturing, and their sizes and shapes throughout cycles of tumbling can be predicted definitely.

Zinc and unhardened steel forms are attainable in "football" and rod-like shapes, sometimes called polishapes and diagonals. Some tumbling departments use sized slugs or punchouts from piercing operations, thereby putting to practical use otherwise scrapped materials. Brads and tacks of unhardened materials are used often for presenting penetrating points to work within small recesses, such as the teeth of small gears.

Hardwood pegs are used extensively in the tumbling of plastics and other soft materials. When loaded with pumice, alumina, or other abrasives they are capable of grinding to remove flash, and for rounding edges. They also are useful, when used with silicone oils or proprietary crèmes, for polishing work.

Felt and leather media are used in some barrel finishing operations. The two materials, being soft and resilient, lend themselves well to the tumbling of soft materials. Like wood pegs, they sometimes are used with abrasives, sometimes with polishing agents, depending on the application wanted.

By no means has this discussion exhausted all possible types and forms of media; there are many more. The intent has been to cover those used generally, and for many applications.

Abrasive Grains and Compounds

Abrasives in the sizes of grains, flours, and aluminas are used extensively in precise barrel finishing, both for loading soft media as explained above, and in self-tumbling processes. Proprietary abrasive compounds contain abrasive grains together with other chemicals, as previously mentioned. But, some barrel specialists prefer to use abrasive powders, bought separately, and compound their own formulas, or use abrasives to which they add chip-grinding compounds.

Among the commonly-used abrasives are aluminum oxide, silicon carbide, pumice, emery, quartz sand (pulverized), and alumina. To this list should be added the somewhat coarser abrasive granules such as quartz sand and ground, hard, nut shells.

Proprietary abrasive compounds contain abrasives sized to be generally acceptable for "ordinary" work. They may not meet the particular demands

Fig. 23. Burnishing shapes.

of some work. Quartz sand, in a size much like that encountered in masonry work, is frequently used for self-tumbling where fine surface color is not important. With its use on unhardened steel parts, as an example, a matte finish should be expected. It is often used in conjunction with descaling compounds, on hardened parts, where its coarse nature helps cut off scale without too seriously cutting the basis metal of the parts.

Flours and aluminas, being relatively small in particle size, find much favor in the fine grinding and polishing of plastics and other soft materials.

The proper selection of compounds for given processes is as important as the choice of barrel types or of media. The difference between old-fashioned, haphazard tumbling and the newer, precise barrel finishing is the knowing manipulation of variables and application of presently available advances in all three. In wet-tumbling processes, and for discriminating results, compounds are a necessary additive.

ABRASIVE COMPOUNDS:

These have been mentioned before, but deserve some special consideration here. Those formerly spoken of as long-cycle compounds employ the harder, tougher grits as their grinding components. Grits of garnet, silicon carbide, and aluminum oxide fit this category. Sizes of grit fall generally between 350 to 180 with some tolerance either way. While long-cycle grinding compounds find their greatest application in self-tumbling processes for heavy burr removal, they also are used, in some cases, in conjunction with chips to hasten cutting with those media. Furthermore, chips which have become glazed from finishing soft materials can be brought back to their proper cutting ability by rolling with abrasive compounds.

Matte finishing must be expected with long-cycle compounds — the smaller the grit size, the smoother will be the matte finish, however.

Short-cycle abrasive compounds usually contain grinding agents which are less tough and hard, or which are subject to fracturing into successively smaller grit sizes. With such types, rapid cutting can be expected for two to three hours. After that time the continual diminishing in size of grit makes grinding continually less severe but, up to a point, keeps refining the finishes of the parts.

Other desirable components of abrasive compounds are agents which promote free rinsing, wetting, oxidation prevention, and detergency. Some sudsing is desirable to suspend "fines" or silts of cut-off metal and other debris which could hamper action of the abrasive. Hard water conditions demand water softening components.

(*To be continued*)

WOOD PEGS

DIAGONALS

ZINC POLISHAPES

Fig. 24.

Science for Electroplaters

59. Cause of Poor Adhesion

By L. Serota

FAILURE of an electrodeposit to adhere to the basis metal is attributed to conditions relating to the operating procedures. E. A. Ollard, in his study of the adhesion of nickel to various base metals, considers the condition of the basis metal and the condition under which the first layer of deposit is made as the two significant factors governing adhesion. A. E. Westman and F. A. Mornheim indicate that the study of the causes of poor adhesion entails consideration as well of factors not associated with the plating operations, such as steps relating to the basis metal and its surface prior to the cleaning and plating operations, and the subsequent effect such operations may have upon the finished (changed and plated) product.

A. W. Hothersall, as a result of his extensive study of the factors affecting the adhesion of electrodeposited nickel on steel or brass, suggests the following as causes of poor adhesion with special reference to nickel deposits on steel: (a) a surface layer of basis metal initially weak or embrittled by hydrogen; (b) foreign material (between coating and basis metal) on surface of basis metal; (c) an initial defective deposit of metal; (d) stresses produced in deposited metal.

Etching

In discussing the factors that interfere with adhesion, Ollard indicates that, in addition to having the surface of the basis metal free from grease and clean, it is essential to include pickling prior to electrodeposition, so that the crystals of the basis metal will be exposed. In support of this view, results are cited of an experiment with two similar steel rods which were pickled for about one minute, or until gassing was quite free, in a 30 per cent sulfuric acid bath, with one sample made the anode and the other sample the cathode.

The nickel, which was then deposited on both samples, placed side by side in the same tank, was easily stripped with a chisel from the plated steel made the cathode, but not from the anodically pickled specimen.

To demonstrate the importance of the conditions relating to the deposit of the first layer (nickel on steel) Ollard investigated the effect of variations in temperature, voltage, and current density upon adhesion. A nickel bath consisting of nickel sulfate, 48 oz./gal.; magnesium sulfate, 6 oz./gal.; boric acid, 4 oz./gal., was made up in a gallon jar. Cast anodes were used. Good results were obtained at 25°C., but below 15°C. the deposits stripped. When an electromotive force of 2 volts was used for the first 10 minutes, with an electrode distance of 4 inches, good adhesion resulted. The deposit peeled, however, when the potential under the above operating conditions was increased to 6 volts. A continued force of 3.6-4 volts and a current density of 10-12 amp. was found to be satisfactory for the rest of the deposit. The result suggests, Ollard implies, that an initial high current density is not an advantage for the deposition of nickel on steel. Good adhesion is favored by higher temperature and lower voltage and current density.

Hothersall also obtained strongly adherent deposits of nickel on steel when samples of mild steel were etched anodically in sulfuric acid, washed, dried, heated to 100°C., then placed in the plating tank. In another series, with citric acid as the etchant, when nickel was electrodeposited upon emeried mild steel, degreased, but not etched, adhesion was not satisfactory. However, when the basis metal was also etched for 30 seconds at 10 amp./ft.^{2} in a citric acid solution and heated at 250°C. for 2 hours after deposition, adhesion increased to 11,200 lbs./in.^{2}. With a 10 minute etch with the same heat treatment procedure, adhesion increased to 33,400 lbs./in.^{2}.

Similarly, Hothersall found that the inherently weak film on buffed brass, which is also susceptible to hydrogen embrittlement, is limited to a surface skin probably less than 0.0005 mm in thickness. Adherent deposits of nickel are possible if such surfaces are etched prior to deposition. Anodic etching will provide a satisfactory surface for adherent deposits of nickel without diminishing the luster. A potassium cyanide solution, and a solution containing citric acid and ammonium citrate, were found to be effective for anodic etching of different types of brass. Etching at a current density of 10 amp./ft.^{2} for about one-half minute was found to insure good adherent de-

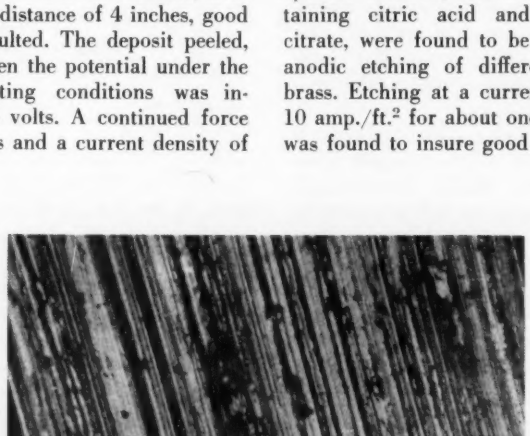


Fig. 230. Polishing sequence: No. 180 only, no lubricant (375X).

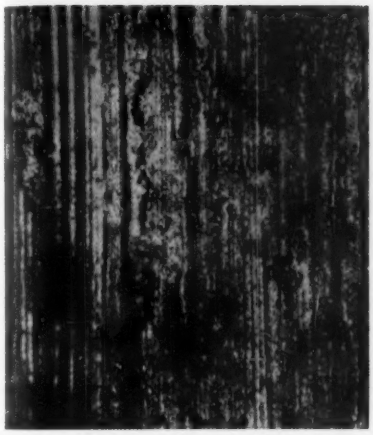


Fig. 231: Polishing sequence: No. 180, dry plus 30 seconds' sulfuric acid anodic etch (375X).

posits of nickel. R. J. Piersol indicates that, in plating nickel on aluminum, etching the surface is essential.

Polishing

W. L. Pinner, in his study of abrasives, demonstrates the difference in surface effect when (NAX) steel, before plating, is subjected to an abrasive polishing, or to the abrasive polishing followed by an anodic etch.

Fig. 230 is a photomicrograph of a sample of an NAX steel surface polished with a dry 180 grit belt. Slivers and fragmented metal are noticeable. Such fragmented metal particles resulting from abrasive polishing, Pinner finds, are damaging to plated coats. Figure 231 represents an NAX steel surface previously polished with a dry 180 grit belt, then etched anodically for 30 seconds in a sulfuric acid bath. Removal of slivers and fragmented metal is appreciable. This demonstrated improved surface conditions resulting from the anodic acid treatment, Pinner adds, has been known to be an effective aid in obtaining better adhesion of nickel deposits to steel.

Pinner found a final polishing operation with a lubricant (greased wheel) to be partially effective in eliminating the ragged appearance resulting from dry wheel operations, thus improving the smoothness of the (nickel) plate on steel. In one polishing procedure lending support to such improved surface conditions, five passes were made on a #100 grit belt, followed by 3 passes on a #150, one pass on a dry #180, and one pass on a #180 grit belt using a grease lubricant. Evidence exists, Pinner adds, that following such operations some slivers still remain imbedded in the scratches, indicating need for improvement.

C. L. Faust attributes the improved operational condition to the milder lubricated cutting of the grease wheel, which removes the loosely adherent, torn metal fragments caused by the dry wheel, without adding any more fragments to the metal surface.

The questionable value of polishing of steel, as a means of improving the surface, following the rolling mill operation, was raised by A. E. R. Westman during a discussion period following the presentation of a paper (with F. A. Mornheim) on the metallographic study of steel used for nickel plating. It was his contention and, he implies, that of other investigators, that results support the view that the surface should be disturbed as little as possible, since adhesion to the disturbed layer is not satisfactory.

The authors note further, in the summary of their review of the literature (up to 1935) relating to the above topic, that an appreciable number of publications favor elimination of polishing operations, where feasible, as a means of eliminating flaw layers, slivers and sharp contours.

The rolling mill will give a smooth surface without the effect of metal disturbance caused by other methods, except possibly by electropolishing. Two photomicrographs made by Lux and Blum were exhibited by Westman to indicate this fact. Fig. 232 is the right side of a cross sectional area of a metallographic specimen of a special SAE 1010 cold-roll steel (2-4 μ.in. rms). The smooth surface produced by rolling (unpolished) is used as the basis metal with copper undercoat and nickel plate. The trace of the original surface of the steel resulting from rolling is clearly evident as a smooth line. Fig. 233 is the left side of the same plated steel with the surface polished. The surface of the steel (basis) metal here shows clearly the rougher or disturbed layer between the basis metal and the copper undercoat. The facts relating to the effect of such disturbances, it is emphasized, are not conclusive, since examples of good nickel plate on copper or steel that has been disturbed are also available.

Beilby Layer

The polishing of a metal surface by mechanical means for the purpose of producing a smooth, shiny finish is effected by abrading, followed by burnishing or buffing or coloring wheels (or tumbling with burnishing mixtures).

The rough surface with visible irregularities is changed, by this procedure, to one wherein irregularities are invisible. F. P. Bowden and P. T. Hughes note that, when a surface change gives specular reflection, the height of such irregularities will be less than half a wave length of visible light.

C. L. Faust states that the brightness of a metal finish is determined by its micro-roughness, and image or mirror-like reflection by macro-roughness. A good mirror finish is characterized by good macro-roughness, while haze is attributed to the scattered or deflected light resulting from the presence of the micro-roughness due to scratches.

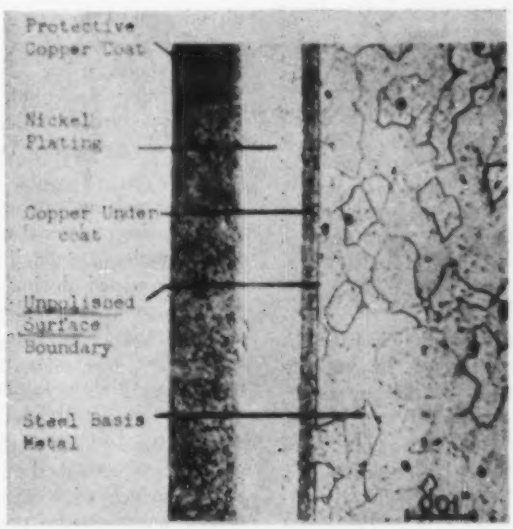


Fig. 232. Lux and Blum panel — unpolished side (500X).

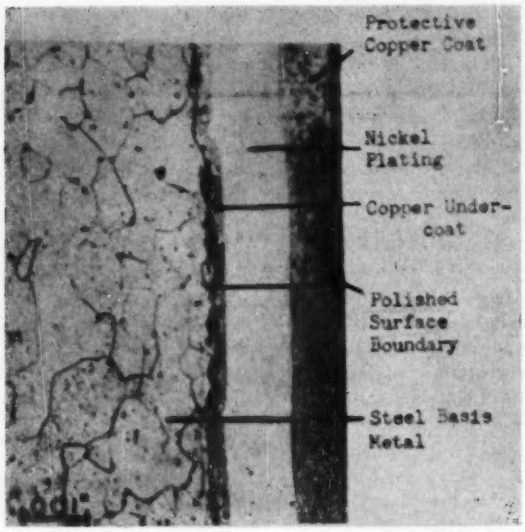


Fig. 233. Lux and Blum panel — polished side (500X).

Abrasive-finishing (mechanical method), Faust contends, results in "smearing-out" the elevations and will not produce scratch-free surfaces.

The mechanism of the process relating to mechanically polishing of metal surfaces has been the subject of study for many years. A significant contribution to the interpretation of surface changes produced by polishing was that proposed by G. Beilby at the beginning of the century. As a result of micrographic study of the various surface changes produced during the polishing process, Beilby expressed the view that, in the final stages of polishing, the surface appeared to flow and became covered with a vitreous, noncrystalline or amorphous layer, a glassy finish which covered the scratches and pits. The film is called the Beilby layer and has the appearance of a supercooled liquid. F. Petrie uses the term "wet luster" to describe the surface of a polished metal. Beilby considered the polishing action one in which the surface atoms are torn off, with the layer beneath this retaining its mobility, momentarily, with the subsequent smoothening effect, due to surface tension, occurring before solidification.

Electron Diffraction

R. C. French, using the electron diffraction pattern formed by cathode rays, with samples of copper, silver, gold, and chromium as test metals, polished with different grades of emery paper and polishing powders, concluded that highly polished surfaces are amorphous, a confirmation of the Beilby theory. The "electron camera" was used in his investigation, since electrons will not penetrate a greater depth than 10^{-6}cm., which limits its action to the outermost surface layer.

The principle upon which the results were determined by this method is based upon the fact that the sharp rings produced by a polycrystalline surface became blurred with a polished surface. Fig. 234, for example, represents an electron diffraction picture of copper rubbed to a flat finish on #0000 emery, etched in hydrochloric acid, and washed in absolute alcohol. The sharp rings, characteristic of polycrystalline substances, are noticeable. Figure 235 shows the same etched copper rubbed with #0000 emery in one direction, then rubbed in a 90 degree direction until the first markings were removed. This was followed by rubbing with chamois, using a liquid polish, then washing in alcohol. The rings, it will be observed, have been broadened and the sharpness lost (a diffuse halo pattern).

G. I. Finch and associates consider the experimental evidence they obtained with electron-diffraction patterns, developed during condensation of metal vapor on a polished substrate and an etched substrate, a confirmation of the Beilby concept that polishing destroys the crystalline structure of a surface.

Zinc, lead, tin, and silver were deposited by this method on polished and etched surfaces of steel, gold, and copper. In each instance the well defined diffraction pattern, which remained for some time on the etched surface, showed a gradual fading on the polished surface. For example, with zinc deposited on polished mild steel, the first layer diffraction pattern disappeared within 3 minutes, whereas, the electron diffraction pattern of zinc deposited on etched mild steel showed no change in intensity after 1½ hours. The authors attribute this fading of diffraction pattern effect to the fact that the polished layer on metals exhibits the property similar to that of a liquid (a property not exhibited by the crystalline surface of the metal) of dissolving to saturation deposited crystalline metal (foreign metal).

H. G. Hopkins determined the thickness of an amorphous layer produced on the polished surface of a polycrystalline metal such as gold to be about 30Å. The polished layer was removed by making the polished metal the cathode in a sputtering chamber. The electron diffraction method was used to determine when the layer was removed. The metal surface was prepared by the procedure used by French.

F. P. Bowden and T. P. Hughes showed experimentally that surface flow, polish, and the formation of the Beilby layer will occur on metals when the melting point of the polisher is higher than that of the solid. Hardness is not an important factor. Cylinders of lead, Wood's alloy, and gallium were pressed against the rotating polisher. The polisher was made of camphor (with polishing substances in powder form embedded in the camphor) because it was soft and had a low melting point, 178°C.

Lead, it was noted, is softer than Wood's alloy or gallium, but lost nothing compared to the loss in weight of the other two. The low melting metal gallium lost the most weight. A pin

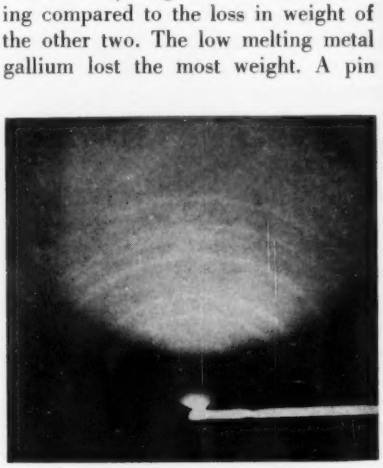


Fig. 234. Etched copper block.

Fig. 235. Etched copper block rubbed on No. 0000 emery and on Blue Bell polish.

scratch on Wood's alloy was covered in the surface flow and a Beilby layer formed. The results, the authors state, indicate a correlation between melting point and surface flow, and that high local temperatures exist which are important in the process of polishing. Where the heat at the sliding contact is sufficient to melt the solid, surface flow will occur or the metal will be smeared on to cooler areas and quickly solidify, to give the amorphous or Beilby layer.

The Beilby layer resulting from polishing, the authors contend, will not necessarily be homogeneous, but will consist of the rapidly-cooled solid with small aggregates and micro-crystals in which oxides and polishing particles may be found.

L. H. Germer raises objections to the amorphous layer interpretation of diffuse diffraction rings (halo pattern). This view is based upon Germer obtaining diffuse rings from high gloss (glassy smooth) surfaces of silicon carbide single crystals and glassy smooth surfaces of poly-crystalline cuprous oxide. Germer questions the probability of attributing such halo pattern, (broad diffusion) to amorphous layers of silicon carbide or cuprous oxide on the respective surfaces. He attributes the diffuse (halo) pattern to leveling, resulting from the polishing of the surface projections, and considers the surface instead to be microcrystalline. The author emphasizes the fact that the results merely question the acceptance of diffuse rings, formed by electrons scattered from polished metal, as the basis for proof of an amorphous layer.

G. I. Finch and H. W. Wilman, as a result of their investigation, contend that the halo pattern from the silicon carbide crystal is due to a vitreous skin. The surface of the silicon carbide crystal, they found, was a silicon film in the vitreous state, since it was softer than the silicon carbide, was soluble in hydrofluoric acid and strong alkali, and may be formed by oxidation at a temperature below the fusion point of silicon carbide but sufficiently high to soften the silica.

S. Dobinski, in his study of the rings of the electron diffraction patterns for polished metal surfaces, found that the spacing of the halos for all metals had the same dimensions, namely 2.25Å and 1.28Å. This similarity, Dobinski considered due to the formation of oxide films on the surface of the metal, during the polishing cycle, rather than the existence of the Beilby (amorphous) layer.

As confirmation of this view, a sample of copper was polished by Dobinski under the surface of benzine. Halos obtained, following this method of polishing, corresponded to spacings of 1.91 and 1.16Å. Similar results obtained when a specimen of copper was polished under pentane seemed to indicate that the (diffraction) pattern of the polished copper was due to the oxide.

For further evidence, the sample polished under benzine was exposed to air. Pictures taken every few hours showed a gradual decay of the original halos and the formation of patterns corresponding to spacings of 2.24Å and 1.28Å. Since the values for the latter patterns (2.24Å and 1.28Å) compare with those obtained previously by polishing in air, the author attributes such results as due to the presence of an oxide.

L. E. Samuels, in his study of surface deformation produced by both abrasion and polishing processes of 70:30 brass, noted a similarity in structure of both the polished and abraded surfaces. This, Samuels contends, would indicate a cutting mechanism for polishing operations rather than the surface flow suggested by Beilby. The Beilby layer, if it does exist, Samuels states, must be considered to be of a thickness of only one or two atom layers, discontinuous, and distinguishable only as a contour of the scratches rather than a smear over the surface. The metallographic taper-section method was used in his investigations. Surface studies were made by optical microscopy. Scratch traces, tests showed, are due to preferential etching.

SYNTHETIC RESINS

(*Continued from page* 48)

high alkali resistance, it is also well suited for washing machine finishes.

Reichhold Resins

Melamine resins made by Reichhold Chemicals, Inc. are of two types:

Super-Beckamine No. 3550-50 falls into the group of melamine resins termed "medium viscosity." The mineral spirits tolerance, compatibility and stability are very good. It imparts hardness and marproofing to an enamel film. Enamels formulated with this resin also have good gloss, gloss retention, and color retention when overbaked. Uses for this resin include high quality automotive finishes, toy enamels, metal furniture finishes and appliance whites. In addition, enamels formulated with this resin exhibit resistance to acids, alkaline materials, and staining materials.

Super-Beckamine No. 3555-60 is classified as a "low viscosity" type of melamine resin. It possesses the characteristics of fast cure, excellent flexibility and chemical resistance. This resin also improves the exterior durability of enamel films. It was designed specifically to produce enamel films with high solids at low viscosity. For this reason it is especially useful for automotive finishes.

Related Considerations

Melamine resins have come a long way in the last twenty years since they were first introduced to industry on a commercial scale. They have provided new concepts of lasting beauty and rugged service in decorative and functional applications, not only in the field of surface coatings but also in the field of molding and laminating.

As may be surmised from the note appended to Table I, melamine and urea resins are closely allied. They can both be considered as "polyamino bodies," and as such undergo similar types of chemical reactions. The next article in this series will discuss these urea resins in some detail.

References

1. Polymers and Resins, by Brage Golding. D. Van Nostrand Co., Inc., 1959.
2. Organic Finishing Handbook, 1954 Edition. Metals & Plastics Publications, Inc.
3. Literature supplied through the courtesy of Monsanto Chemical Co., American Cyanamid Co., Rohm & Haas Co., Allied Chemical Corporation, and Reichhold Chemicals, Inc.

SHOP PROBLEMS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Cleaner Formulations

Question: We propose to use the following solution for the cleaning of galvanized steel prior to phosphating:

Sodium metasilicate (granular)	85%
Tetrasodium pyrophosphate	10%
Sterox A.J.	5%

We would appreciate your comments as to the suitability of this solution when used at a concentration of 4 oz. per gallon, at a temperature of 180°F. to boiling.

We would also appreciate being advised if it is possible to obtain copies of articles from previous issues of METAL FINISHING.

W. J. B.

Answer: Although the cleaner formulation appears satisfactory, we cannot say whether it will be suitable for the application, since it is the type of soil on the galvanized parts which will determine the cleaner formulation.

It is customary to purchase proprietary mixtures which are formulated for the particular application, and the supplier can advise which of his materials will be suitable.

Due to the continuing demand for copies of articles, the desired ones may not be available. However, photostats can be purchased from most large libraries, such as the New York Public Library and the Engineering Societies Library in New York.

Adhesion of Lacquer to Nickel Plated Parts

Question: The parts we are having trouble with are made of brass rod. We are compelled to conform with government specifications as far as the air dry lacquer is concerned. Our difficulty is spray painting these caps so that the paint does not chip off during handling and shipping. I do know this happens because of poor bonding of the paint to the metal part.

The procedure of the parts to be finished is as follows:

a) Parts are degreased
b) Bright acid dip
c) Barrel nickel plate
d) Dry and send to another department for inspection
e) Return to plating department to be sand tumbled to remove outer surface of nickel and at the same time roughen so that they can be painted later
f) Before painting they are sent to another department to have a rubber washer placed inside them, which is called a cap plate
g) Return to plating department to be racked and sprayed.

I would appreciate it very much if you could help me with a suggestion to improve better adhesion of paint to the brass part without having any effect upon the nickel on the inside of this cap. The government requests nickel on the inside for corrosion resistance.

A. D. P.

Answer: Not having seen the items in question, we are only able to offer an educated guess as to the most likely causes for the condition.

Could there be something in the sand tumbling media which may be adhering to the parts and which later offers a separation layer? If so, remove it or change the operation to say something like a mild etchant. In putting the rubber washer (cap plate) inside, are the operators leaving oily or acidy fingerprints? Perhaps, if this is the cause, degreasing may remedy the situation. Are the parts being sprayed correctly? Prevent possible dry-spray by proper thinning and holding the spray gun a distance consistent with air and fluid pressures.

Barrel Nickel Plating

Question: We are now barrel plating nickel direct onto steel parts that are approximately 3/8" O.D. 1" long and have in them a threaded hole 1/8" x 3/4" long. After plating these parts we thoroughly rinse and dry them in our spin dryer, and then we reverse the load by dumping them back and forth and spin drying them again. We have tried everything and we still have a complaint of rust on the inside hole. Is there any way that you know of which will prevent this?

J. B.

Answer: Since there is no possibility of nickel throwing into the threaded holes of the parts, they will have no protection against rusting. If, after nickel plating, you were to apply a heavy phosphate coating, you might have some protective value. However, we do not know if the phosphating treatment will have any effect on the nickel finish.

Nickel-Manganese Plating

Question: I recently evaluated a strip of preplated cold rolled steel and it appeared that the plate was an alloy of nickel and manganese.

I do not know the source of this preplated strip and can find no reference to plating of this particular nickel — manganese alloy. Would you kindly advise me who does this type of plating and what are the advantages of this particular plate.

A. E. J.

Answer: Our files disclose no references to a commercial nickel-managanese plating process of any type. We question whether the deposit is actually composed of these two metals and would suggest further checking of the composition.

Tellurium Bath

Question: Does your GUIDEBOOK include information on tellurium plating? We need whatever data can be found on this bath, and your very early reply would be appreciated.

F. N. C.

Answer: There is no information on deposition of tellurium in the METAL

FINISHING GUIDEBOOK, since this is not a common coating metal.

The only reference we find on the subject is a paper by F. C. Mathers and H. L. Turner, published in the Transactions of the American Electrochemical Society (Vol. 54, p. 293. 1928). A suggested solution consisted of the following:

Tellurium dioxide	300 g./l.
48% Hydrofluoric acid	500 "
Sulfuric acid	200 "
Temperature	20-30°C.
Current density	15-30 amp./sq. ft.
Anodes	Tellurium

An exhaust should be provided since the bath evolves HF fumes.

Pickling Brass

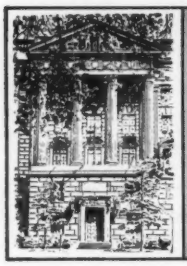
Question: We would like some information on pickling brass before satin plate. We are manufacturers of tubular brass plumbing goods. On some of the parts we solder a threaded collar which is made from high leaded free cutting brass and the solder is 40 tin and 60 lead.

The procedure we have used for a number of years, but has not been too satisfactory, consisted of alkaline cleaning and a soak in 10% by volume sulfuric acid at 160°F. As an experiment, we tried the dichromate dip, instead of the sulfuric pickle, with good results until finally it went completely flat and would not brighten the parts at all. The dip was made with 4 oz. sodium dichromate and ½ pint sulfuric acid per gallon, and was used at 145°F.

We would appreciate it very much if you can tell us what we are doing wrong. We have sweetened up the dichromate dip by adding proportionally sodium dichromate and sulphuric acid. This works for a time, but finally goes flat.

N. F. B.

Answer: The dichromate dip loses effectiveness in a short time and can be rejuvinated only once or twice before dumping. If the hot sulfuric pickle is used first, to remove scale, you will then require only a short dip in the dichromate pickle to brighten the surface, thus extending its life. The dip can also be operated at room temperature, which will result in less attack on the brass and, consequently, less contamination.



Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Anodizing Magnesium

U. S. Patent 2,926,125. *Feb.* 23, 1960. *J. E. C. Currah, A. Rudin and M. Morf, assignors to Canadian Industries Limited*

A method of producing a corrosion-resistant coating on the surface of a magnesium or a magnesium base alloy article, which comprises immersing the article as the anode into a solution having a pH of at least 8 and consisting essentially of water, an alkali metal borate in a concentration of at least 0.05% by weight calculated as diboron trioxide, and a substance selected from the group consisting of hydrogen peroxide, soluble peroxygen compounds and compounds which yield hydrogen peroxide in a concentration of at least 0.001% by weight calculated as hydrogen peroxide, while passing an electric current through the solution.

Strippable Organic Coating

U. S. Patent 2,927,036. *Mar.* 1, 1960. *A. L. Seaver III*

A protective coating composition consisting essentially of 10 to 25% cellulose acetate butyrate dispersed in organic solvent, said composition also containing from about 8 to 18% of plasticizer and 0.2 to 1.5% of soybean lecithin and forming a substantially clear, stable film upon drying which is readily removable from the surface to which it is applied.

Spray Coating Hollow Bodies

U. S. Patent 2,927,044. *Mar.* 1, 1960. *E. J. Gough, assignor to Minimax Ltd.*

A method of spraying the interior surface of a hollow article including the steps of rotating said article in a first circumferential direction at a uniform speed; directing a spray of coating material against the interior surface of said article and progressively moving the spray axially with respect to said article to thereby coat successive portions of the interior surface thereof.

Organic Coating

U. S. Patent 2,927,046. *Mar.* 1, 1960. *D. S. Andrade, assignor to Parker Rust Proof Co.*

A composition for coating metallic surfaces which consists essentially of tertiary butyl alcohol and chromic acid, said chromic acid being dissolved in said tertiary butyl alcohol in an amount between about 1% and saturation.

Chromium-Iron Bath

U. S. Patent 2,927,056. *Mar.* 1, 1960. *G. R. Schaer, assignor to the United States of America*

The method of electrodepositing a chromium-iron alloy plate which comprises electrolyzing an aqueous bath consisting essentially of from 20 to 75 grams per liter of trivalent chromium ions, 10 to 150 grams per liter of ions chosen from the group consisting of the alkali metal and ammonium ions, 0.6 to 2.5 grams per liter of ferrous ions, and 8 to 65 grams per liter of sulfamate ions.

Control of Pickling Baths

U. S. Patent 2,927,871. *Mar.* 8, 1960. *E. B. Mancke and C. W. Shingledecker, assignors to Bethlehem Steel Co.*

A method of maintaining in balance an acid pickling bath which comprises determining the concentration of said acid by measuring the conductivity of the bath and when said conductivity falls below a predetermined limit, automatically adding concentrated sulfuric acid to the bath in an amount sufficient to increase the conductivity of the bath to a predetermined limit, determining the concentration of said sulfate by independently measuring the specific gravity of the bath, and when said specific gravity rises above a predetermined limit, automatically adding to the bath a solution of sulfuric acid in a concentration approximately equal to the predetermined treating agent concentration and in an amount sufficient to reduce the specific gravity of said bath to a predetermined limit.

Dyeing of Aluminum Oxide Coatings

U. S. Patent 2,927,872. *Mar.* 8, 1960. *C. C. Cohn, assignor to Samuel L. Cohn and Charles C. Cohn*

The method of producing colored oxide coatings on aluminum and aluminum alloys comprising absorbing in such oxide coating an aqueous solution containing a minimum of 0.040 gram per liter of a hydrolyzable salt of a weak metallic base and an anthraquinone dye of the group consisting of anthraquinone dyes of the mordant type, mordant acid type, acid type and metallizable type, followed by sealing of the dyed coating by treatment with an aqueous solution containing a minimum of 0.040 gram per liter of a hydrolyzable salt of a weak metallic base.

Corrosion Prevention — Stainless Steel

U. S. Patent 2,927,873. *Mar.* 8, 1960. *E. B. Bengtsson and O. I. Olsson, assignors to Aktiebolaget Bofors*

Method of enhancing the corrosion resistance of acidproof steel which comprises subjecting said steel to the action of dilute nitric acid, the concentration of the acid being about 33%, in the presence of a member of the group consisting of a salt of phosphoric acid and phosphoric acid at a temperature above 185°C. and at a pressure within the approximate range of from 3° to 40 kg. per square cm.

Conversion Coating Aluminum

U. S. Patent 2,927,874. *Mar.* 8, 1960. *G. H. Pimbley, assignor to Turco Products, Inc.*

A process for producing a substantially colorless chemically bonded coating on an aluminum article, which comprises forming a colored conversion coating on said article, said coating containing a yellow hexavalent chromium material, and contacting said colored conversion coating with an aqueous solution consisting essentially of a soluble agent capable of discharging the yellow color of said hexavalent chromium material present in the conversion film, said color discharge agent reacting chemically with the hexavalent chromium to form a

LEA

ABRASIVE FINISHING METHODS

SILVER PLATE

In the silverware field and more recently in the electronic and missiles fields,wear-resistant plates of silver are electro-deposited on nickel silver, copper, brass, steel and other metals. The base metal is brought to a smooth finish by cut-down buffing, regardless of whether the final silver finish is to be a mirror or a butler finish. The methods of producing these finishes are the same as given in previous **Data Sheets on Abrasive Finishing for the Various Metals,** with some modifications.

HAMMERED FINISH...A hammer-finish appearance on silver plated items is accomplished by first hammer-finishing the base metal and imparting a satin or bright finish, approximating the desired final finish which the silver plate will duplicate. Subsequent buffing of the silver plate should be done with a grade of **LEA COMPOUND** or **LEAROK** as suggested for producing the various finishes listed below, particularly where the silver plate is milky white in appearance.

DULL SATIN FINISH...Base metal is first satin finished to the degree of coarseness wanted with **Grade "B"** or **Grade "L" Lea Compound** on a loose muslin buff at 5000 sfm. After plating, the plated finish can be given a final **dull finish** with one of the finer grades of **Lea Compound,** such as **"MH"** or **"B-12."** The finishing operation should be done in the same direction as the base metal coarse finish lines, so that the final finish will show no crossing of the abrading lines.

SPECIAL FINISHING
BRIGHT BUTLER RELIEVED, OXIDIZED FINISH

Sometimes, a **bright butler relieved, oxidized finish** is required which will show the dark silver sulphide in the recesses of the design. In such cases, the articles are "oxidized" immediately after the silver plating operation and the parts are then **relieved** and **butler finished** in one operation with **Lea Compound** such as **Grade "B-12,"** on a loose muslin buff at 7500 sfm.

These standard finishes are produced as a final finish on the silver plate. Prior to silver plating, the base metal must be adequately prefinished with a Learok or Liquabrade as recommended in data sheets for bright finishing of the specific metal.

DULL BUTLER FINISH...**Grade "MH" or "B-12" Lea Compound** on a full disc or packed muslin buff at 7000 to 7500 sfm.

BRIGHT BUTLER FINISH...**Grade 5023 Lea Compound** on a loose muslin buff at 7500 sfm.

SEMI-MIRROR AND MIRROR FINISHING...A **semi-mirror finish** can be produced on **Silver Plate** with **884 Learok-Bar Compound,** on a loose muslin buff at 7500 sfm. **Grade A-100 Greaseless Red Rouge** bar compound, or **Grade 90LR Liquid Rouge** will give a satisfactory mirror finish.

ULTRA-MIRROR FINISH...Proceed as with mirror finishing and follow with lamp black and kerosene in slurry form applied to a soft canton flannel buff.

Tailored Gold Plating Process

...there's a specific Lea-Ronal Gold Process to meet your own exacting requirements

Over the years Lea-Ronal has conducted considerable research and development on Gold Plating. From this research and development have come numerous processes each with its own characteristics that makes it outstanding for a specific type of operation. Every member of this Lea-Ronal family of Gold Processes has been production-tested and has been instrumental in improving the quality and production of the users' plating operation.

If you are plating gold, you should investigate these standout Gold Processes.

for pure Bright 24.00 K acid gold

AURO GLEAM 24.00

—a pure 24.00 K bright acid gold bath containing absolutely no alloying elements and representing a radical departure from all previous type bright gold processes. Will produce bright deposits directly from the bath. Solution is very stable, simple, and economical to operate. Wide bright current density ranges. Designed specifically for printed circuitry and electronic uses requiring a 100% pure bright gold deposit.

bright acid golds with microleveling

AURO GLO 4

—a bright acid type gold with freedom from porosity with microleveling. Suitable for heavy coatings up to 0.003 inches. Bath has wide plating range, is very stable, and produces hard deposits of 23.9 K. Metal distribution is superior to cyanide gold baths. Successfully used for electrical connectors, semi-conductors, and the like.

for 'Hamilton' shades with extreme hardness

AURO GLO 12

—an acid type alloy, bright gold, producing shades of a Hamilton color. Particularly adaptable for decorative finishes. Bath has wide bright plating range, produces deposits of exceptional hardness (375-400 Knoop). Simple color control.

for bright high speed gold plating

AURO GLO H. S.

—a neutral type, high speed bright gold. Deposition rates of 0.003 inches per hour can be obtained from standard bath. Can utilize the same equipment as standard cyanide golds. Simple to control. Broad bright plating and temperature range.

for hard flash coatings

HARD GOLD FLASH

—hard gold flash salts. A simple process for depositing flash coatings and plates up to 40 millionths that are bright to semi-bright. Deposits are hard of Hamilton type shade. Bath has zero free cyanide, which makes for ease of control.

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substantially colorless reaction product, and substantially discharging the color from said conversion coating, said color discharge agent being one capable of producing a visible discoloration from a colored conversion coating when immersed in a 2% aqueous solution of said agent at a treatment temperature of 120°F. for a period not more than 15 minutes.

Iron-Coated Uranium

U. S. Patent 2,928,168. *Mar.* 15, 1960. *A. G. Gray, assignor to the United States of America*

A metallic uranium article having an adherent coating of iron electroplated directly on the uranium base and a corrosion-resistant adherent aluminum coating on the electroplated iron coating.

Plating on Molybdenum

U. S. Patent 2,928,169. *Mar.* 15, 1960. *J. G. Beach and C. R. Schaer, assignors to the United States of America*

An article composed of molybdenum, a strike coating of chromium plated thereon, a layer of gold plated on said strike coating of chromium, and a substantially thicker layer of chromium plated on said gold.

Automatic Painting Machine

U. S. Patent 2,928,369. *Mar.* 15, 1960. *R. B. Way and C. D. Hersey*

In a spray painting machine, in combination, a mask holder, means for supporting said mask holder, a mask having an open portion held by said holder, said mask conforming to uniformly curved surfaces upon which designs are to be painted, a sprayer for painting said uniformly curved surfaces and oriented to direct a spray toward the open portion of the mask held by the holder, and means for moving the sprayer along an arcuate path.

Automatic Conveyor

U. S. Patent 2,928,401. *Mar.* 15, 1960. *V. Finston, assignor to The Meaker Co.*

In a processing machine, a series of processing stations, work carriers each for supporting first and second work units spaced in the direction of advance of the work carriers along said series of stations, a transfer space at at least one end of said series of stations and means for moving successive work carriers along said series of stations.

Automatic Conveyor

U. S. Patent 2,928,402. *Mar.* 15, 1960. *V. Finston and W. Kostner, assignors to The Meaker Co.*

In a processing machine, a framework, a series of adjacent treatment stations, track means supported on said framework and extending longitudinally along said series of treatment stations on each side thereof, work carriers spanning between said track means and having rollers for riding on said track means for supporting work carriers as they are moved along said track means between successive stations, and conveyor means mounted on said framework.

Water-Wash Spray Booth Compound

U. S. Patent 2,928,498. *Mar.* 15, 1960. *T. Schmid-Nisoli and A. Paul, assignors to Ciba Ltd.*

In the absorption of the spray of organic liquids in lacquer spraying chambers by surface contact with water the improvement which comprises using, for absorbing the spray of the organic liquids, water which contains a water-soluble cellulose ether of an aliphatic hydroxy compound of low molecular weight.

Electroless Nickel

U. S. Patent 2,928,757. *Mar.* 15, 1960. *W. G. Lee and E. Browar, assignors to General American Transportation Corp.*

The process of plating with nickel an amphoteric element selected from the group consisting of titanium, zirconium and hafnium; said process comprising cleaning said metal surface by contact with a suitable cleaning bath, then conditioning said metal surface by contact with a pickling bath comprising an aqueous solution of hydrochloric acid and hydrofluoric acid and a mild oxidizing agent, the absolute concentration of hydrochloric acid in said pickling bath being about 8 mole/liter, the absolute concentration of hydrofluoric acid in said pickling bath being about 4½ mole/liter, then contacting said metal surface with a chemical plating bath of the nickel cation-hypophosphite anion type throughout a sufficient time interval to obtain a nickel plating upon said metal surface, and then heating said work-piece to a temperature at least as high as about 425°C. so as to effect a diffusion reaction at the interface between said nickel plating and said metal surface.

Phosphate Conversion Coating

U. S. Patent 2,928,762. *Mar.* 15, 1960. *M. Hyams, assignor to Neilson Chemical Co.*

Process which comprises treating a ferrous surface successively in the stated order with an acidic aqueous phosphate coating solution whereby to form an adherent coating consisting at least in part of ferrous phosphate, at least one aqueous preliminary non-oxidizing rinse of a non-oxidizing acid solution having a pH of less than 4.5 and a final acidic aqueous rinse solution comprising ions of hexavalent chromium.

Chromate Conversion Coating

U. S. Patent 2,928,763. *Mar.* 15, 1960. *W. S. Russell and J. L. Van Vliet*

An aqueous acidic solution for coating aluminum and alloys, which consists essentially of 5-150 g./l. phosphate ion, 2.5-62 g./l. CrO_3, 1-55 g./l. aluminum ion, the hydrogen ion and between about 2.5 and 123 g./l. of fluoride ion, said fluoride ion varying with the aluminum concentration, the pH of the solution being between about 0.8 and 1.5, as measured by the lowest value indicated by glass-electrode pH meter within the first 10 minutes of immersion of the electrode in the solution.

Electropolishing

U. S. Patent 2,928,777. *Mar.* 15, 1960. *G. H. Smith, assignor to Electro Process, Inc.*

A method of anodically polishing metals which comprises immersing the metal to be treated for from 1½ to 5 minutes as an anode in an aqueous electrolytic bath consisting of 1.0 to 50% by weight of an aromatic hydrocarbon sulfonic acid and 50 to 70% by weight of 85% orthophosphoric acid, the current being of sufficient density to overcome any etching and result in a polishing of the metal being used as an anode.

Zinc Brightener

U. S. Patent 2,928,800. *Mar.* 15, 1960. *C. J. Wernlund, assignor to E. I. du Pont de Nemours and Co.*

The process of preparing a zinc brightening agent comprising reacting in a dilute aqueous solution, at least 1% by weight of polyvinyl alcohol,

and an amount of H_2O_2 at least equal to 8.5% by weight of the polyvinyl alcohol present in the reaction mixture.

Gas Plating — Aluminum

U. S. Patent 2,929,739. *Mar.* 22, 1960. *E. R. Breining, W. M. Bolton and F. O. Deutscher, assignors to Union Carbide Corp.*

In an aluminum deposition process, wherein a substrate is heated in the presence of a heat decomposable aluminum alkyl compound; the improvement which comprises: intermixing in the gaseous state a heat decomposable aluminum containing compound which tends to form hydrides of aluminum and an unsaturated compound capable of reacting with such hydrides to form the heat decomposable aluminum compound.

Buffing Wheel Mount

U. S. Patent 2,929,175. *Mar.* 22, 1960. *E. E. Murray.*

In a buffing machine, a work engageable, wearable buffer member mounted on a supporting frame for pivotal back and forth movement a distance necessary for continuous engagement of the buffer member with irregularly shaped workpieces.

Hot-Dip Zinc Coating

U. S. Patent 2,929,740. *Mar.* 22, 1960. *J. E. Logan, assignor to The Wean Engineering Co., Inc.*

The method of coating a metal with zinc which comprises heating a mixture of zinc and sodium containing not less than 10% nor more than 15% zinc with the balance being substantially pure sodium to a temperature between 1000°F. and 1300°F., protecting the bath from the atmosphere, and immersing the metal therein until it is coated with zinc.

FOREIGN LITERATURE

Swiss Technicians Discuss Metal Plating Problems

A number of technical papers were presented at the October 1959 Meeting of the Swiss Electroplating Society (*Schweizerische Arbeitsgemeinschaft fuer Galvanotechnik*), held in Zurich. Summaries of these papers are given below.

Mechanical Testing of Plated Metal Coatings

By R. Weiner.

Although metal plating technology is very old, the really efficient processes have been developed only in comparatively recent times. A reason for this relatively slow development lies partially in the fact that efficient test processes for judging the plated coatings were lacking. In this respect also, even today, there is still left a great deal to be desired. A field which has been particularly neglected is that covering the mechanical testing of plated coatings.

The test methods which give the most reproducible results are those covering hardness measurement. The methods in most widespread use comprise the Vickers, Brinell and, in the U.S.A., the Knoop tests. Measurement of the micro-hardness is the only important factor with plated metal coatings. The special details encountered in this connection were then discussed.

The hardness of the plated metal coating can be very variable, according to the composition of the plating bath and the production methods. Bath additions are available, which have an effect both in raising and in lowering the hardness. The influence of operating conditions during plating and, particularly, the current density and temperature, is not entirely a linear function but is governed also by the bath composition. This is the reason why conflicting statements regarding the hardness of electroplated metal deposits are often encountered in the technical literature.

A very bad fallacy also, is to draw conclusions regarding the other mechanical characteristics of a coating, particularly with regard to the wear-resistant properties, from the hardness test figures obtained. Great hardness very frequently can be associated with a very poor resistance to mechanical stressing.

The scratch hardness shows a close relationship to the wear-resistance of the plated metal. With a similar hardness of different plated coatings, in general, those showing a high scratch-hardness figure are superior to those with a low scratch hardness figure.

Plated Coating Thickness Measurement

By R. Weiner

The plated coating thickness as such is often completely uninteresting and is only of significance in association with other characteristics of the deposit, such as porosity, corrosion resistance, and wear resistance. In the case of the noble metals, the metal value can play a role. As a standard, and for the calibration of other test methods, the preparation of a cross-section and measurement of the coating thickness under the microscope, can serve.

Rapid test methods that are practical either damage or destroy the test part or can be non-destructive. In the first case, the coating is dissolved away completely or in a limited area.

Either the thickness change or the loss in weight is then determined and, thus, absolute values are obtained. A simpler method of operation is the determination of the dissolving time with the use of various phenomena as the end-point indication. With this, it is necessary to make a standardization with comparison samples of completely identical characteristic. Normal and bright plated coatings for example, should not be compared.

The modern non-destructive processes are based on the measurement of magnetic or electrical characteristics, which must be different for the basis metal and the coating. The simplest processes are based on the measurement of the magnetic attraction and make possible measurement at required spots. Nickel and iron can also be measured today.

Electrical eddy current methods can be applied in many cases where magnetic measuring processes fail but, at the moment, are only at the beginning of their development. Spectroscopic processes and those test methods which are based on through-radiation with X-rays or beta-rays, can only be considered for special projects, at present.

Pores in Metal Plated Coatings; Examination and Significance

By A. Kutzelnigg

The author gave details in this

paper of the results obtained by the Pore-Testing Sub-Committee of the German Standards Committee. In this work, attention has been directed particularly to test methods for nickel and chromium. The method in most widespread use for nickel coatings is the Ferroxyl test. This test is conducted in varying ways but, in every case, the nickel is attacked. A greater porosity is falsely rendered by pitting corrosion.

The pores are defined as hollow spaces in the plated coating, conditioned by the production conditions. The pores are filled with air or other foreign bodies. A distinction must be made between pass-through pores and masked-off (sealed) pores. The causes of pore formation in plated coatings were discussed in the paper. In actual practice, the pores are of a threefold nature:

1. Surface defects of the base, support material (surface roughness, traces of previous working, pores, slag lines, oxide inclusions, etc.).

2. Defects due to local faulty covering of the surface in the bath (gas bubbles, grease and oil, graphite, carbon, grinding and polishing residues, loose metal particles, hydroxides or basic salts, anode slime, other materials in suspension in the bath).

3. Defects through bath actions or subsequent effects (imperfect covering, cracks as a result of stresses in brittle coatings, craters through subsequent damage, through-polished places, chemical action after deposition).

These various causes of defects were discussed in detail and classified in tables. It was stated that alpha-nitroso-beta naphthol is to be recommended in place of the aggressive Ferroxyl test. It was found that nickel coatings can be pore-free in very thin coatings (of the order of 50 Å).

Bright chromium coatings are porous in the form employed at present and are fissured. As a result of passivation of the chromium, it acts in a corrosion-facilitating manner on nickel. The application of thicker chromium coatings on nickel is to be recommended.

Corrosion Behavior and Electrochemical Testing of Plated Coatings and Cover Coatings

By G. Oelsner.

The author gave details in this paper of comprehensive tests that have been conducted in the State Institute for Materials Testing, Berlin. These tests were carried out so as to be able to draw conclusions regarding the corrosion behavior of plated coatings, from theoretical fundamental considerations. Some 56 metals and alloys were investigated.

The usual electrochemical voltage test series, based on the normal potentials, gives no clear indication of the corrosion behavior in practice. The nature of the corroding influences is of decisive importance. Practical voltage series were obtained in synthetic sea water of pH 7.5 and in a chloride-free buffered solution of pH 6. Table I gives these values. Static current-voltage curves were also obtained.

In addition, for the practical behavior of the various metal combinations, apart from the position in the the electrochemical series, the nature of the curves and the surface relationships of the two metals to one another are further decisive factors. Broad qualitative predictions for various cases could be made in this manner it was found.

Thus, for example, zinc containing 1.5% lead, in contact with steel in sea water, gives no protective action, on account of the passivation of the zinc by the lead. Pure zinc, however, shows a good protective action. It was found that the corrosion potential of the zinc is not influenced by the nature of the electrolytes (plating baths) used, i.e. acid or potassium cyanide, or by organic brightening addition agents.

On the other hand and contrary to this, it was found that bright nickel coatings are inferior in corrosion behavior to those obtained from the normal mat baths. Iron corrodes in every case, in contact with nickel. The extent of the corrosion depends on the surface relationships. An 18-8 chromium-nickel stainless steel is passivated by copper in chloride-free media.

Further investigations were conducted on chromated zinc and cadimum coatings. In Table 2 are shown the electrochemical voltage series ascertained in these tests.

TABLE I
Electrochemical Voltage Series of the Elements and "Practical Voltage Series".

Practical Voltage Series in Water pH 6.0	*mv.*	*Electrochemical Series*	*mv.*	*Practical Voltage Series in Sea Water pH 7.5*	*mv.*
Silver	+194	Silver	+ 799	Silver	+149
Copper	+140	Copper	+ 340	Nickel	+ 46
Nickel	+118	Lead	— 126	Copper	+ 10
Aluminum	(—169)	Tin	— 140	Lead	—259
Tin	(—175)	Nickel	— 230	Steel	—335
Lead	(—283)	Cadmium	— 402	Cadmium	—519
Steel	—350	Iron	— 440	Aluminum	—667
Cadmium	—574	Zinc	— 763	Zinc	—806
Zinc	—794	Aluminum	—1660	Tin	—809

TABLE II
"Practical Electrochemical Voltage Series" for Plain and Chromated Zinc and Cadmium Coatings in Water at pH 6.0 and in Synthetic sea Water at pH 7.5

Metal Coating	*Type of Finish*	*Water mv.*	*Sea Water mv.*
Zinc	Unchromated	—794	—806
"	Transparent	—848	—778
"	Transparent	—847	—761
"	Yellow	—848	—763
"	Olive	—849	—740
Cadmium	Unchromated	—574	—519
"	Transparent	—528	—488
"	Yellow	—499	—468
"	Olive	—507	—478

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Museum 2-2410

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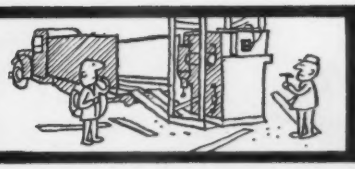

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Organic Coating for Aluminum

Cosden Paint Co., Dept. MF, Beverly, N. J.

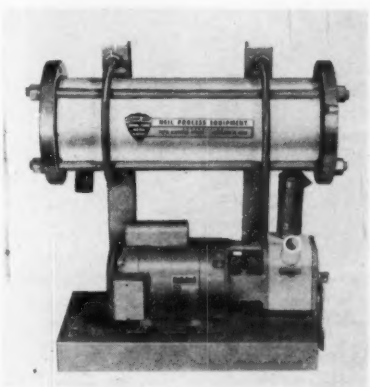
A coating which can be applied directly to uncleaned and untreated aluminum, available in clear and a wide range of colors, is a high-gloss baking synthetic with exceptional adhesive properties. It forms a tough, abrasion-resistant film which will not scratch, rub off or crock. One formulation even exhibits very good resistance to exposure.

The coating can be applied by spray or roller coating methods. Excellent coverage is achieved due to the high solids and tough film. At the recommended film thickness for aluminum foil, 0.0002", one gallon will cover over 3,000 square feet. Baking schedules vary from 10 seconds at 500°F. to 15 minutes at 300°F. or equivalent according to the thickness of the aluminum.

Graphite Heat Exchanger

Heil Process Equip. Corp., Dept. MF, 12850 Elmwood Ave., Cleveland 11, Ohio.

The new Series 1231 heat exchanger units complete with recirculating pump are designed for heating or cooling acids or other liquids in tanks having capacities up to 900 gallons. The combination package heat exchanger and pumping unit is very compact, measuring approximately 28" long, by 10" wide and 20" high.



These units have given excellent service with nickel plating solutions where low filter flow rates are desirable and, due to the chemical inertness of the Nocordal impervious graphite construction, can be used with practically any acid solution.

The heat exchangers are of solid block construction, practically eliminating the possibility of breakage and assuring long efficient operation. Flow capacity are from 5 to 15 gallons per minute.

Rack Coating

Anderson's Plastics Co., Dept. MF, Box 416, Natick, Mass.

'Rack-Guard' is a long-lasting and efficient rack coating that dries fast without heat treatment. It is also useful as a touch up or top coat for vinyl plastisol coatings and as a stop-off for plating solutions.

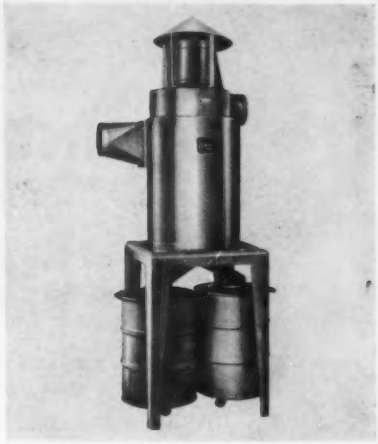
The product is compounded of vinyl similar to that used in plastisol coatings, and is combined with a specially developed resin that gives the coating a hard and glossy surface, facilitating rapid run-off of plating solutions. Because the coating was developed to be resistant to solvents, it does not build as fast as vinyl plastisols when applied to the rack. However, successive coats can be applied without lifting. It can be also applied over most plastisol formulations.

The coating can be applied by dipping, brushing or by spray. Methyl ethyl ketone will thin it rapidly. Overnight drying is recommended before the racks are used. Moderate heat can be used to hasten the drying.

Dust Collector

Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

Features of the cyclone type DK 1055 Duskolector include a direct



driven self-cleaning fan unit powered by a 7½ HP, 3,600 r.p.m. motor, which gives a 3,500 c.f.m. rating. Regular inlet size is 10" diameter. Multiple inlets are available to accommodate ductwork to a number of dust sources.

This new model comes equipped with two 55 gallon drums mounted on casters for easy disposal of dust, chips and dirt. Only the very light dust particles are exhausted outside. The 55 gallon drum arrangement is also available for the smaller models.

Vibratory Finisher

M-F Equip. Co., Dept. MF, Newark, N. J.

Of unique design, a new tub-type vibratory finisher is reported to achieve rapid finishing without impingement damage to work pieces, as a result of controlled, positive elliptical movement of the work container, a radical innovation in equipment of this type.

The new unit offers infinitely variable amplitude from 0 to ⅜". Amplitude is positive, generated by mechanical cam action, and is easily adjusted without disassembly of the unit. Once adjusted, it does not vary as a result of changes in frequency or weight of load, and is not affected by the reaction of the suspension system. The motor, isolated from the vibrating elements of the assembly, provides a

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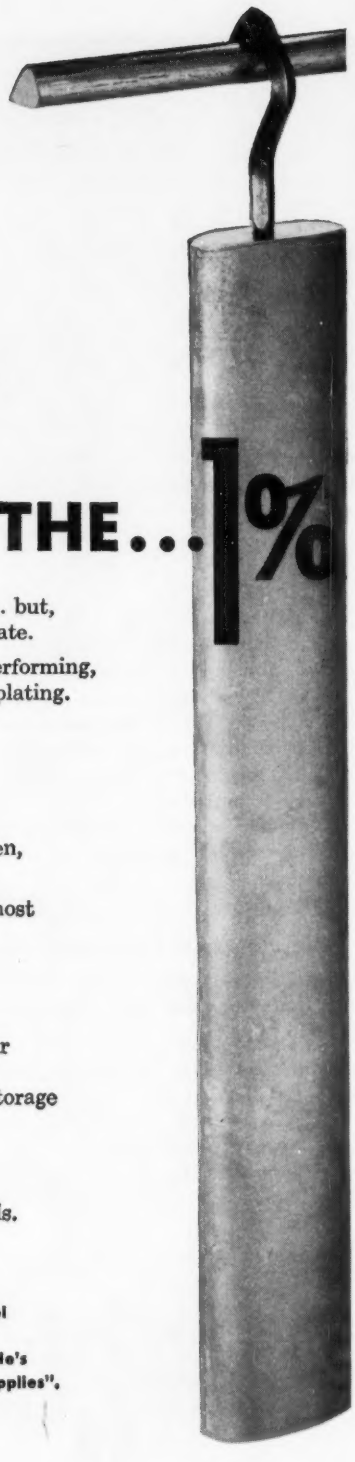

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frequency range from 700 to 1800 c.p.m., through a V-belt drive. The tub-type work container is easily removed from the machine without disassembly of other components, and all sub-units are easily accessible.

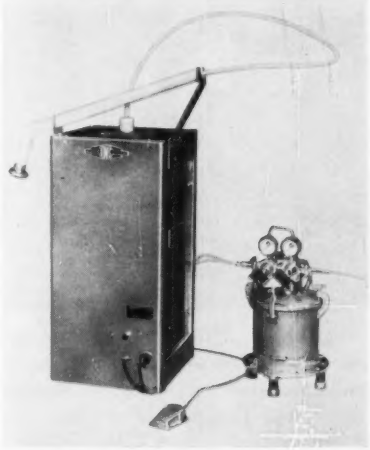
The new Vibraslide vibrafinisher is offered in capacities of 1, 5 and 10 cubic feet, and larger capacities are available on order.

Electrostatic Hand Gun

Ionic Electrostatic Corp., Dept. MF, 111 Monroe St., Garfield, N. J.

A new portable, high-speed, centrifugal-type electrostatic hand gun applies both metallic and non-metallic paints and coatings, and can be used both for indoor and outdoor work. The Model 10 Hand Gun creates atomization by centrifugal force, installs easily into existing systems, makes possible quick color changes, requires no special skill for operation, has practically no maintenance cost and covers large or small items. Clean-up time is drastically reduced, production increased and product quality improved, it is claimed.

The gun weighs only 1¾ pounds and the power supply, which weighs



94 pounds, operates from a standard 115 volt single-phase source. Ventilation is needed only to remove solvent vapors and building heat loss, therefore, is drastically reduced.

To further increase its flexibility, the new gun is available with either a straight or 45° angle head, as well as in models that will apply three individual or mixed colors. In addition to its adaptability to all types of objects, large or small, the new gun is being used for both conductive and non-conductive coating applications. Enamels, plastisols, porcelain enamel, waterbase coatings and numerous other types of coating materials can be applied with ease.

Liquid Replacement for Rochelle Salts

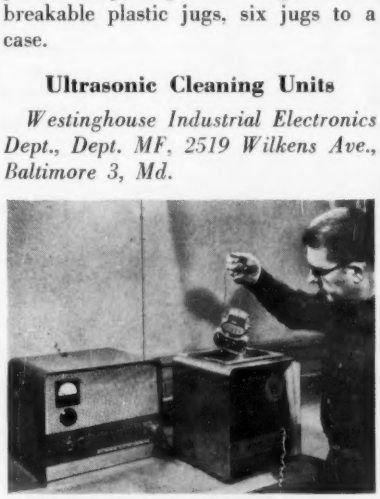
Cowles Chemical Co., Dept. MF, 7016 Euclid Ave., Cleveland 3, Ohio

A tartrate plating additive, called TPA, is a direct replacement for rochelle salts in bronze, brass, copper strike, and copper plating solutions. It is a liquid concentrate which goes into solution instantly without fuming, and the tartrate added this way is claimed to provide more uniform anode corrosion and greatly increased cathode efficiency.

A 1% solution is equivalent to 1 ounce per gallon of rochelle salts in direct substitution. Standard procedures, including lab checks for tartrate concentration, can be maintained. The product is packaged in one gallon unbreakable plastic jugs, six jugs to a case.

Ultrasonic Cleaning Units

Westinghouse Industrial Electronics Dept., Dept. MF, 2519 Wilkens Ave., Baltimore 3, Md.



This new solid state console line offers a self-enclosed generator and tank mounted on casters for easy movement. The models consist of a ten gallon tank with a 1,000 watt gen-

erator and a ten gallon tank unit with a 250 watt generator — both enclosed in an attractive cabinet and stainless steel top.

The portable units employ the 50% more efficient solid state Trinistor controlled circuit and the space-lamination Magnopak transducer. The ultrasonic cleaning systems have neither moving parts nor tubes and the equipment size has been reduced.

Vibratory Tumbling Barrel

Syntron Co., Dept. MF, 732 Lexington Ave., Homer City, Pa.

These self-contained, compact units are available in three models with 0.4, 1, and 6 cu. ft. barrel capacities; larger models will be available in the near future. They are designed to reduce parts handling, incorporating a screen cover and hose connection for flushing out compounds and a screen trough to separate the parts and media. The same directional vibration that finishes the parts, moves the parts and media across the screen dressing for rapid separation.

The amplitude of vibration can be varied instantly by a turn of the rheostat knob on the control box. The same compounds and media used in other tumbling equipment may also be used in the vibratory barrel tumbling machines.

Rinse Water Additive

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

Entek CU-56 is a new rinse water additive which is claimed to inhibit corrosion of copper and brass. The

product produces an invisible film which prevents tarnishing, staining, spotting-out, green salt formation, pit corrosion and finger marking of copper and its alloys. It is designed to preserve freshly plated or cleaned metal surfaces during storage.

The neutral liquid is used at a concentration of one gallon to every 99 gallons of water, and should be used as a final stagnant rinse following copper or brass plating, or following cleaning of copper and brass sheet, strip or tubing. A brief immersion of 5 to 30 seconds is sufficient to provide protection against 200 hours of tropical humidity conditions. One gallon of the made-up rinse will treat approximately 500 sq. ft. of metal surface. The product does not contain chromates and does not present any waste disposal problem.

CU-56 is a rapid version of CU-55; it reacts with copper and brass 20 times as fast as Entek CU-55. The coating improves the solderability of copper and brass by reducing tarnishing during the warm-up period prior to flow of the solder. It also improves the adhesion of lacquers and enamels.

Ultrasonic Cleaning Unit

Powertron Ultrasonic Corp., Dept. MF, Patterson Place, Garden City, N. Y.

These new ultrasonic units are completely self tuning, and eliminate the need for operator training and constant operator attention. Since the only control needed is a simple on-off switch, the Autosonic also does away with the risk of abuse by untrained operators. Even operation for a reasonable length of time with an empty tank, which burns out conventional units, cannot damage the error-proof cleaner, because it tunes itself to the lack of activity in the tank, it is claimed.

The feedback transducer measures the amount of ultrasonic activity (ultrasound waves) in the cleaning tank, and corrects output phase and frequency to maintain the standing wave condition. Consequently, maximum cavitation is maintained automatically for all conditions. Thus, heating or cooling, change of solvent, variation of product or material to be cleaned, or other changed conditions have no effect on the efficiency of the ultrasonic system. It is a piezoelectric unit, with an efficiency of more than 90 per cent,

as compared with 30 to 70 per cent for magnetostrictive and conventional ceramic block transducers.

Cleaning systems ranging in capacity from 100 to 3,000 watts are available. Among them are generator-tank combinations in a variety of sizes from ¾ gallon to 75 gallons. In addition, modular construction allows for cleaning systems of virtually unlimited capacity. The line also includes a versatile vapor degreaser, dual purpose sink consoles, immersible transducers, and a complete range of accessories, detergents, and solvents.

Rust Preventive

Mitchell-Bradford Chem. Co., Dept. MF, Wampus Lane, Milford, Conn.

Rust-Pel #5 is a concentrated, rust-proofing, formulated compound which is added to water in recommended proportions, depending upon the extent of rust prevention required. The solution can be used either at room temperature or heated, and can be applied by dipping, brushing, or spraying.

It leaves a dry, rust-proofing film on the metal surfaces which is non-oily and non-greasy, and cannot normally be detected either visually or by touch. It is also extremely water repellant, which adds to the corrosion resistance.

The product gives nominal indoor and in-plant protection, and is also very effective as a final dip for plated items which require additional corrosion resistance, it is claimed. The material is packaged in 5-gallon and 55-gallon drums.

Paint Stripper

Esbec Corporation, Dept. MF, P.O. Box 929, Stamford, Conn.

Speedi-Strip 1030, an especially effective paint stripper which is diluted with 4 to 20 parts of water, is a new, acidic chlorinated solvent which is

used at room temperature and is non-flammable.

This new product will effectively strip many of the new synthetic coatings and the manufacturers cite additional advantages for it:—

1) Effective on epoxy and other synthetic enamels as well as many other modern coatings, and plastisols.

2) Strips fast — Usually in 2 to 15 minutes (longer for heavy plastisols).

3) Breaks the bond, does not dissolve the paint. Therefore, lasts longer.

4) Can be used with most metals, including aluminum and zinc.

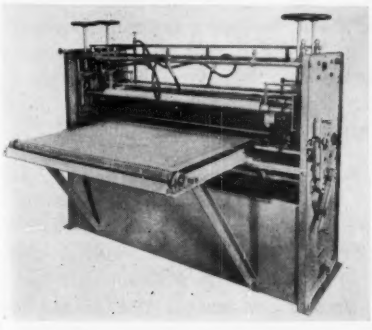
Double Roll Coater

Gasway Corp., Dept. MF, 6463 N. Ravenswood Ave., Chicago 26, Ill.

A new heavy duty double roll coater Model No. 54-B employs the double roller principle, which eliminates flow marks when applying a heavy film of lacquer and air dry materials. According to the manufacturer, it also applies an adequate film in grooves and similar hard to coat areas. To achieve uniform coating on long panels and to eliminate overlay, a scraper bar is provided on the coating roll.

The machine is made of rugged T-type steel plate and can handle material up to 48" wide and up to 3" thick. The synthetic rubber coating rolls are 6" in diameter by 54" long, and the paint metering rolls are turned out of solid bar steel and measure 3½" in diameter and 51" long. Each coating roll is fully adjustable without changing the setting of the metering roll. A single hand adjustment raises and lowers both sets of coating rolls equally. Paint supply is retained by adjustable end seals on the coating rolls.

Each metering roll has a single side adjustment for paint film thickness and is provided with equalizing adjustment so that uniform pressure is exerted across length of coating roll. The lower drive roll is accurately ground and hard chrome plated. External hand levers engage drive rolls and special steel doctor blades are provided to keep drive roll clean and to provide easy clean up of machine.



All rollers have self-aligning ball bearing mounts with roller chain and sprocket drive to each roll. Ball bearing idle sprockets are equipped with automatic chain take up for perfect adjustment at all times.

The unit has a 1 HP, totally enclosed motor with heavy duty worm gear reducers for easy maintenance. A variable speed V-belt drive with conveniently located control, runs the machine at 30 to 90 r.p.m. All drip pans are easily removed for cleaning.

Optional equipment includes a paint circulating pump at a slight additional cost, a feed in and feed out conveyor, and a safety bar control for operator safety.

Chemical Polish for Zinc Die Castings

Conversion Chemical Corp., Dept. MF, Rockville, Conn.

A new powder, known as Kenvert No. 55, is combined with nitric acid and water to form a solution for chemically polishing and bright dipping zinc die castings.

The solution may be used before plating to brighten the subsequent plate. It may be used to improve the appearance and corrosion protection of die castings used without further finish. It may also be used to restore the finish to castings that have been spoiled through paint or plate stripping, corrosion in process of manufacturing. It produces an excellent finish for adhesion to paint or lacquer, it is claimed.

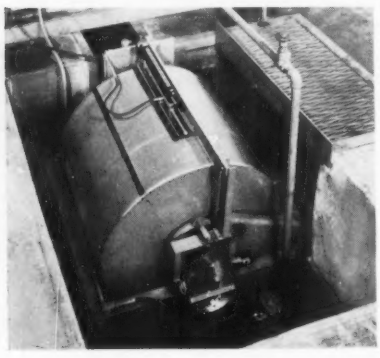
The solution is effective for deburring zinc die castings if stock removal requirements are small. It can be used for either bulk or rack processing. It is easy to control, has good life and is economical. It is packaged in 100 lb., and 400 lb., polyethylene lined steel or fiber drums.

Rotary Industrial Filter

Murray-Way Corp., Dept. MF, P.O. Box 180, Birmingham, Mich.

A compact, new strainer type rotary industrial filter provides unusually large filtering capacity in proportion to floor space occupied. Known as "Model #10," this automatic filter is made up of eight simplified, screw-

mounted screens on a rotating drum. The contaminated fluid is carried by gravity down the entrance chute and into the turning filter drum. As the

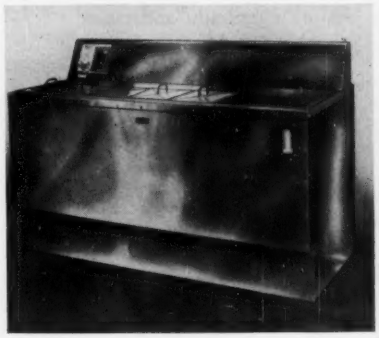


filtered fluid drains to the tank below, the sludge-coated screen rotates, constantly moving a clean filtering area into position. Special reciprocating air nozzles, located at the top of the filter drum, "air-peel" the caked contaminant from the screen into the exit chute. This continual self-cleaning action readies the screen for more efficient filtering. There is no filtering media to throw away, and no operator is required. Jogging action of the exit chute accelerates discharge of contaminants, and brace-scoops extend across the turning drum, carrying any loose contaminant to the exit chute.

Air pressure requirement is 40 to 60 p.s.i., and air usage is approximately 16 cubic ft. free air per minute when filter is in continuous use. An optional float switch is available to turn the drum only when contaminant cake restricts filtering, thus conserving on air usage. An air pressure regulator, gauge, and lubricator are provided.

Transistor Washer

Barnstead Still and Sterilizer Co., Dept. MF, 223 Lanesville Terrace, Boston 31, Mass.



A new model transistor washer, completely enclosed in stainless steel cabinet, has been designed for washing and rinsing transistors, diodes, missile parts, large power tubes and electronic parts.

The purification system consists of regenerative heat exchanger, cartridge holder for organic removal cartridge, cartridge holder for demineralizing cartridge, submicron filter, storage reservoir with cooling coil, recirculating pump, flow meter, thermometer, purity meter with inlet and outlet cells, low water cutoff to protect tank heating elements.

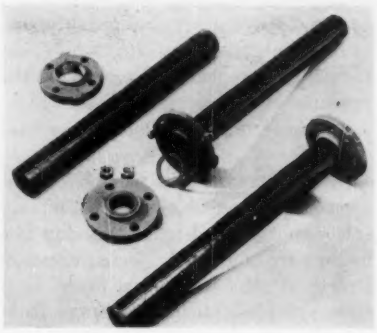
The wash system provides five separate rinses of extremely pure hot water. Final rinse is about 18 megohms and 210°F. The water is constantly repurified by an organic removal cartridge, a demineralizing cartridge, and submicron filter. A minimum amount of heat is required since the system contains its own regenerative heat exchanger. The water is continuously recirculated and repurified, thus saving thousands of gallons of pure water daily, and eliminating the need for a larger capacity purification system.

Furane Plastic Pipe

Cornelius A. Rauh & Associates, Inc., Dept. MF, 1191 Sunset View Drive, Akron 13, Ohio.

A new and unique line of easy-to-

install reinforced furane plastic pipe is particularly suited for use in the processing and transferring of acids, alkalies, and solvents. Called "Eonite," the new chemical-resistant pipe is strong, dimensionally stable and can carry, without distortion or deterioration, hot corrosive liquids and gases at temperatures up to 300°F., at pressures up to 150-psig. Due to streamlined design, smooth bore, and its hydrophobic property, it permits increased flow rates (to as much as 20



per cent greater than steel pipe of the same size).

Ease of installation is a feature. It is designed for leak-proof field assembly with a patented ring lock joint, which includes two cast iron standard A.S.A. flanges, two 4° tapered rings, and a hard asbestos gasket impregnated with neoprene and graphite. Pipe can be cut to length with a hacksaw or brick saw, and a screwdriver and wrench are the only tools needed for quick installation. Bolt circles provide easy connection to valves, tanks and existing pipelines.

The new furane plastic pipe is available in 15-ft. lengths in seven sizes with wall thicknesses from 5/16-in. to 9/16-in., and from 2-in. to 12-in. I.D. Also offered are 90° and 45° ells, tees, and reducers.

Phosphate Coating

Detrex Chemical Industries, Inc., Dept. MF, P.O. Box 501, Detroit 32, Mich.

Detrex 910 is an entirely new approach to iron phosphate coating. While it chemically cleans and phosphate coats in one operation it is so compounded that it is able to accept up to 15 times more alkali than other products, it is claimed. Despite this high hard water tolerance, the product still remains in the proper pH coating range to produce superior iron phosphate coating. Thus, it can be used in practically all areas within the United States without requiring any special pH control.

The compound is designed for use in continuous mechanical spray washing equipment ranging from a 2 to 6 stage operation. Thoroughly field tested and proved in actual field operations, it is fully guaranteed.

Vibratory Finisher

Almco, Queen Products Div., King-Seeley Corp., Dept. MF, Albert Lea, Minn.

A new bench model vibratory finishing machine, No. VT-70, is 14" long, 11½" wide and 13¾" high. The tub has a capacity of ¾ gallon and can be removed from the top of the housing of the vibratory mechanism. The fixed vibration frequency of the unit is 3,300, which is designed to permit fast finishing action while maintaining high finishing standards.

The machine employs the new concept of precision finishing through vibratory movement of the horizontal tub. The "scrubbing action" thus produced enables fine finishing to be accomplished with great efficiency. Parts can often be finished from 10 to 100 times faster than formerly possible with conventional finishing machines.

Protective Coating for Brass

Bee Chemical Co., Logo Div., Dept. MF, 12933 S. Stony Island Ave., Chicago 33, Ill.

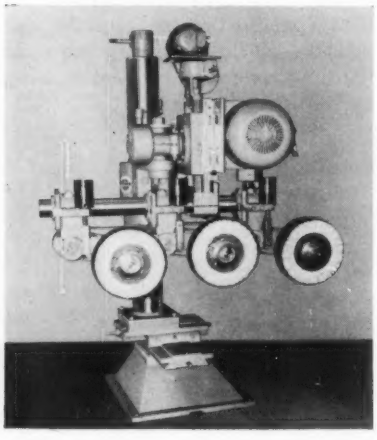
A new corrosion-protective system for use on brass and brass plated steel, is said to produce a protective film based on an entirely new concept in metal corrosion protection. The process involves a simple wetting of the metal surface by dip or other means with a non-flammable water-thinnable material, Lacqua M-800. When used as recommended, the coating shows no rainbow or iridescence effect, no blush, and does not alter the color of the material.

The system offers savings on insurance rates to present users of flammable coatings. Water-wet parts coming directly from a water rinse following the plating operation may be dipped in the material, eliminating intermediate drying or use of precipitating solvents.

Triple Head Buffing Lathe

Acme Mfg. Co., Dept. MF, 1400 East Nine Mile Road, Detroit 20, Mich.

A new compact adjustable triple head buffing lathe provides three buffing operations in a minimum amount of floor space. This design permits the use of 3 buffing heads in a space normally required for 2 conventional single heads.



The adjustable lathe is equipped with floating heads operated by individual air cylinders to maintain uniform part buffing pressure. Each head can be individually adjusted for float. The heads can be easily adjusted from a vertical to horizontal position. The three buffing heads can be individually set at separate speeds through a special pulley arrangement.

An Acme standard interchangeable power drive unit raises and lowers the buffing heads, adjusts the in-and-out slide and provides automatic buffing wheel wear compensation in pre-set cycles and feed amounts. Wheel wear compensation can be provided manually. However, the automatic feature cuts machine downtime for manually adjusting heads to compensate for wheel wear.

The machine occupies a floor space approximately 5′ x 5′ and is 7′ high. Center distance between heads is 20″. Motor horsepower of the lathe will vary from 10 to 25 depending on the buffing application.

Cleaner-Phosphater

Turco Products, Inc., Dept. MF, 24600 S. Main St., Wilmington, Cal.

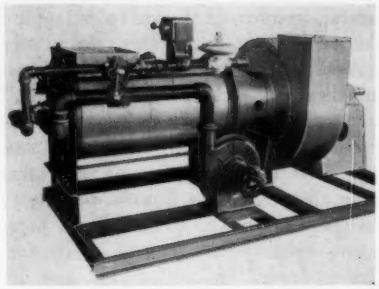
A new phosphating compound for simultaneous cleaning and phosphating of iron, steel and zinc, Paintite is applied by immersion, spray washer or steam cleaner. It is claimed to be a superior cleaner that produces a light (up to 70 mg./sq. ft.), very tight, smooth and uniform phosphate coating assures paint adhesion and prevents the rapid post-rusting of metals before painting. It is extremely low foaming, low sludging and free rinsing, and requires a minimum of temperature control when used between 140-180°F.

Low Pressure Gas Air Heater

W. S. Rockwell Co., Dept. MF, 200 Eliot St., Fairfield, Conn.

A series of heaters for supplying recirculated hot air at temperatures up to 600°F. to ovens, dryers and other heat processing equipment, is highly efficient, compact and requires exceptionally low maintenance.

The insulated cylindrical heater body is equipped with low pressure gas burner and combustion air blower, firing into a refractory combustion block centered in an extended alloy steel combustion tube. A conical alloy steel baffle beyond the tube deflects the hot gases into a recirculating air



stream, leaving the heater into the recirculating fan located beyond the heater outlet. Such pull-through action causes a negative pressure to be maintained in the heater. The use of the pressure burner system provides high-low or modulating control of combustion.

The heater and its completely integrated combustion system, piping, safety controls and regulators, fan and motor are mounted on a common structural steel bed. It is made in 6 sizes provided a capacity range from 500,000 Btu/hour to approximately 4,000,000 Btu/hour.

Infrared Ovens and Equipment

Radcor, Inc., Dept. MF, Bradner, Ohio.

A complete line of infrared heating equipment and infrared ovens consists of components, modular oven sections, that can be used singly or constructed in custom form by the customer, and a group of oven units designed and built for basic commercial and industrial operations. These ovens include batch type, vertical, horizontal, portable, tower, coal and ore car thawing types and ovens for use with monorail or floor-type conveyors.

For flexibility in application, the equipment is divided into two series: the "L", in which all linear heat sources may be used, and "G", which will accommodate all G-30 lamps spaced on 12-inch centers. Only two basic parts are required for an oven in either series, modular sections and frame wireway or frame.

The modulars are sturdy steel housings with double backwall construction. In the "L" series, they come in two widths, 6 inches and 12 inches, and in four lengths. In the "G" series, they are available in a 12 inch width and in three lengths. In both series, the reflectors, which back up the heat sources, are optically designed to produce correct heat distribution. Several

types of reflecting materials are available.

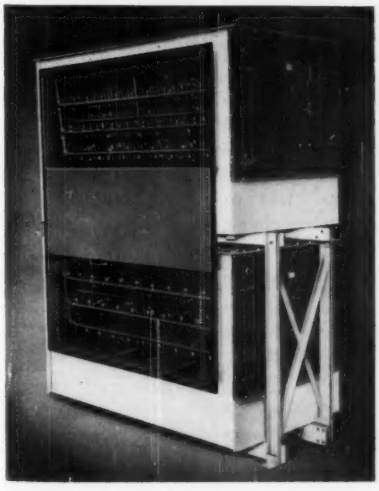
The frame-wireway is a heavy gauge channel which serves for the collection of wires from various sections, a housing for terminal blocks, supporting framework for the oven, and can serve as an air chamber for applications where forced air is required to cool terminals and lamp seals. The frame wireway has also been designed to permit contouring to fit various oven requirements.

The oven also comes in a complete range of basic shapes and sizes. They are said to be built to J.I.C. and F.I.A. specifications and are easily adaptable to any special customer requirement. They are available with or without ventilation systems or electrical control systems. The heat sources offered consist of metal-sheath heaters, quartz tubes, quartz tungsten lamps or G-30 tungsten lamps.

Fume Scrubbers

S & C Mfg. Co., Dept. MF, 3533 Cardiff Ave., Cincinnati 9, Ohio

The Hi-Boy Air Washer design consists of a three-section cleaning process that assures removal from the air of 90 to 99% of the contaminants soluble in water or that can be made soluble in water. First, the high velocity of the contaminated air is reduced, while the air is washed by a spray nozzle system. From the spray chambers, the air enters PVC Raschig ring scrubber bed, where direct action of more spray nozzles assures a clean washed surface for maximum absorption of contaminants. Finally the air enters a PVC eliminator section, where any particles of heavily entrained water still remaining are removed, completely voiding the air of any particles of water to enter the exhaust fan.



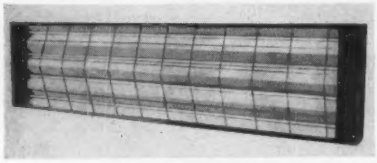
Due to the combination spraying system and PVC Raschig ring scrubber bed design, the unit has a very low water consumption for spray action type washers, approximately ½ to 2 g.p.m. per thousand c.f.m. of air being handled. At the same time, the equipment has a very low static pressure drop of ¾" across the entire unit, minimizing power consumption.

PVC construction, in addition to prolonging life through its anti-corrosive formulation, also reduces weight and size, simplifying shipping and installation. For instance, a 30,000 c.f.m. unit weighs only 1,800 pounds. Similarly, modular design of the 30,000 c.f.m. unit, with two 15,000 c.f.m. models stacked vertically, saves additional floor space. Nearly 12 feet tall, it is only 102" wide by 52" deep. Stacking also allows for the use of only one plenum and one plumbing location. The units later can be separated and used in different areas if desired as individual air washers, or another unit can be added on top of the double-deck arrangement.

Simple inspection and cleaning at any time is provided by easily removable side and top plates. Similarly, inspection doors at the spray chamber and eliminator section allow examination while the washer is in use.

Radiant Heat Panel

Edwin L. Wiegand Co., Dept. MF, 7500 Thomas Blvd., Pittsburgh 8, Pa.



Designated Chromalox type QRP, these radiant heat panels are equipped with quartz tube elements. The new series is designed to provide excellent terminal and resistor life and to obtain maximum serviceability from the quartz heat source.

Compact in size, dimensions are one foot by four feet. Four and six kilowatt panels are available for 208 and 240 volts, while the 240 volt elements may be connected in series for operation on 480 volts.

Where large areas of radiation are involved, the panels may be mounted horizontally at any angle, end to end, and edge to edge on ½" conduit stems, also, on metal framework using ¼" bolts for which spot-weld nuts are provided on the back of each panel. Single-end wiring by the user is facilitated by a built-in wiring gutter.

For maximum effective radiation, each panel is equipped with a bright-nickel plated steel grille with reflecting ability in excess of 80%. Heat loss through the panel is inhibited by insulation between reflector and panel back. To make mounting and interconnecting easy, ten ½" conduit knockouts are provided in each panel.

Ultrasonic Cleaner

Narda Ultrasonics Corp., Dept. MF, 625 Main St., Westbury, N. Y.

A self-adjusting ultrasonic cleaning system, called the SonBlaster Automatic, is now available in a five-gallon size and will soon be available in all sizes of the line. The only operating control is a simple On-Off switch, which makes practical unattended large-scale production line installation and remotely controlled equipment.

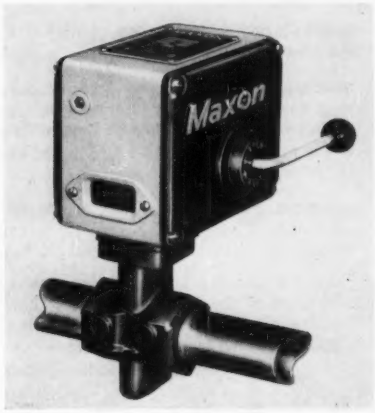
Conspicuously absent from the new ultrasonic generator are the usual knobs and the meter required to adjust the activity in the ultrasonic tank. This advantage is realized by providing a controlled spectrum of ultrasonic frequencies that excite a multi-resonant transducer. The result is a uniform distribution of energy and the elimination of standing waves and regions, of low activity.

The unique features of the unit are obtained by the use of a modulated saturable core reactor in combination with a multi-resonant transducer. In this device, a controlled spectrum of frequencies excites every efficient resonance of the system. No longer is the critical selection of transducer elements required in the manufacturing process — every transducer resonance is utilized.

Safety Shut-Off Fuel Valve

Maxon Premix Burner Co., Dept. MF, 201 E. 18th St., Muncie, Ind.

When connected with one or more safety circuit-breaking instruments and installed in gas or oil supply lines leading to the burners of industrial boilers, furnaces, ovens, and other processing equipment, the new Series



800 Manual-Reset Valve shuts off flow of fuel automatically and instantly upon any break in the electric power or safety circuit.

Incorporating a body with unique "guillotine" action, the valve assures tight closure. It is approved and listed by testing laboratories of Associated Factory Mutuals, Underwriters Laboratories, and Canadian Standards Association, and is regularly accepted and approved for industrial application by Factory Insurance Association and other such regulatory bodies. Catalogs and engineering data sheets available.

Gas-Fired Intake Air Units

Hartzell Propeller Fan Co., Dept. MF, Piqua, Ohio

A redesigned line of gas-fired air intake units for supplying make-up air to replace that removed by exhaust systems is now available from the above manufacturer.

Four basic units give a capacity range of from 15,000 to 90,000 c.f.m. (1,000,000 to 7,000,000 B.t.u./hr.) The basic units include the burner, controls and belt or direct driven fan in a single housing, and assembled to meet job requirements with optional accessories including turning elbow, shutters, filter house, and outlet diffusers. Controls systems can be supplied to meet all operational, local code and insurance approval requirements.

Paint Pigment

Pigment, Color & Chem. Div., Sherwin-Williams Co., Dept. MF, 260 Madison Ave., New York 16, N. Y.

Benzidine Yellow HH 12229, a high hiding, low oil absorption type Benzidine Yellow pigment for lead-free paints, has been especially designed for use when Chrome Yellows are not suitable because of restrictions on lead and where Hansa Yellows will not stand the baking temperatures involved.

The low oil absorption characteristic makes it different from other Benzidine Yellows. The high gloss of enamels made with the pigment is maintained for the life of the coating.

This new standard, having the good heat resistance of Benzidine Yellows, may be used in normal baking schedules common in the paint industry. It has the maximum opacity that can be obtained with Benzidine Yellow, and does not bleed in synthetics, but does have a slight bleed in lacquer.

As the pigment is a toluidide type, it is not a permanent color and should not be used where outside exposure is expected.

Armored Hose

Samuel Moore & Co., Dept. MF, Mantua, Ohio.

A new steel-armored hose with outstanding resistance to fire, heat and mechanical damage, Synflex "Hi-Temp" was originally developed as paint-carrying drop lines for the world's largest manufacturer of automobiles to reduce fire hazards in the

spray painting of automobile bodies. It is also ideally suited for chemical lines and handling flammable fluids.

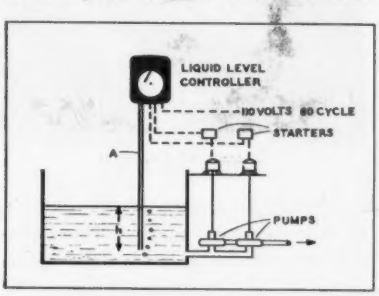
The outer protective covering is 0.012″ thick galvanized steel armor. The central core is a specially formulated seamless nylon tube, covered with black vinyl, wrapped with Mylar-backed asbestos tape.

The hose is available with inner diameter of ⅜″ and outer diameter of 0.718″. A 5/16″ inner diameter size will be available shortly.

Level Control

Foxboro Co., Dept. MF, Foxboro, Mass.

Combining the familiar bubble tube method of measuring level and the reliability of Rotax electrical control,



a "packaged" control unit is now available for use in industrial processing and in water and sewage treatment plants.

Features of the instrument are ±0.5 per cent accuracy, ranges from 0-10 inches of water up to 0-10 feet of water, no cleaning or servicing problems, simple to install, even in inaccessible locations such as reservoirs and underground tanks.

The new controller consists of a compressor, a purge rotameter, diaphragm pressure element, damping restrictor, Rotax contacts, plug-in relays and a pump sequencing relay. It can be furnished as an indicator, a recorder, or — where long distance transmission is required — as a telemeter transmitter. All components are housed in a single instrument case, to which a bubble tube is connected.

In operation, the compressor forces just enough air through the immersed bubble tube to assure continuous escape of the bubbles. As the level of the measured liquid changes, the diaphragm reflects a corresponding change in back pressure in the tube and positions the instrument pen or pointer accordingly. The contacting unit, actuated by the measuring element, makes or breaks contact at preset liquid levels to operate pumps in the tank outlet line and thus maintain the correct level.

NEW BOOK

Tin and Its Alloys

Edited by E. S. Hedges. Published by Edward Arnold (Publishers) Ltd., 41 Maddox St., London, W.1, England. 1960. 424 pages, including index. Price: $27.50.

This book is confined to tin and its alloys mainly from the standpoint of properties and applications, and avoids the refining process and chemical compounds. Subjects treated are cast and wrought forms of tin, physical metallurgy, chemical behavior, and coating by electrodeposition and hot-dipping, including tinplate, which would be of most interest to the finisher. However, solders, bronze, and bearing alloys are also discussed, so that peripheral subjects with which the finisher is at times in contact are also available for examination.

The book maintains a balance between theory and practice, and the detail in which the finishing aspects are presented, about 40 per cent of the book, warrant its recommendations to those in the field.

BUSINESS ITEMS

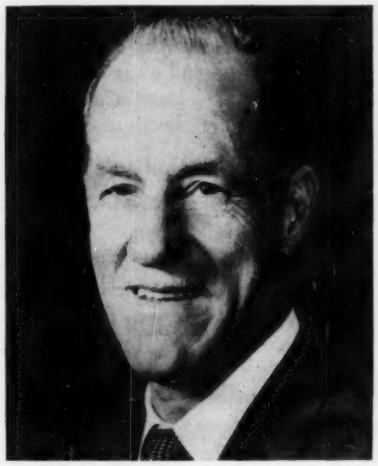
Oakite Appoints Lamb Detroit Division Manager

Daniel B. Lamb has been appointed Detroit division manager for *Oakite Products, Inc.*, pioneer manufacturers of specialized chemicals for industrial cleaning, sanitizing, and metal treating. He replaces *Thomas R. Smith*, who is retiring after nineteen years as head of the Detroit division.

Mr. Lamb joined the company as a technical service representative in Knoxville, Tenn., in 1947. For the past seven years he has served industry in the Kokomo, Ind. area. In 1956 he received the company's citation for distinguished service to industry.

Daniel B. Lamb

Gulley Elected President of Singleton Co.



Thomas W. Gulley, Jr.

Thomas W. Gulley, Jr., an authority in metal finishing equipment and processing since the 30's, has been elected president of *The Singleton Co.*, 15585 Brookpark Road, Cleveland 35, Ohio. Other officers elected are *Thomas R. Gill*, vice-president and treasurer, and *Kenneth Kolinski*, secretary.

Production Machine Becomes a Division of Wanskuck

Wanskuck Co., Providence, R. I., announces the purchase of *Production Machine Co.*, Greenfield, Mass., manufacturer of centerless grinders and polishing machines. The firm, employing about 60, will continue to operate in Greenfield with its existing personnel. *Anthony J. Spada* has been appointed general manager of the firm to replace the late *Raymond A. Cole.*

Universal Paint Appoints Bonfich Technical Director

W. Bonfich has been named technical director for *Universal Paint & Varnish, Inc.* Since joining the company early in 1959, he has devoted his efforts principally to completing development work on the firm's coatings for metals and plastics, and water-base paints. A graduate of Case Institute of Technology, he has done extensive research in the fields of plastics and protective finishes both at Case and in industry.

Detrex Places Emmett in Charge of Mfg.

R. A. Emmett, Jr., vice-president of *Detrex Chemical Industries, Inc.*, has been placed in charge of all chemical and equipment manufacturing. He will also direct the activities of the firm's

R. A. Emmett, Jr.

laboratory and research center in Detroit.

W. S. Rockwell Co. Establishes Plastic Coating Div.

W. S. Rockwell Co., Fairfield, Conn., announces the establishment of a Plastics Coating Division to provide a variety of thermoplastic finishes on surfaces of metal objects for corrosion resistance or decorative purposes.

Complete facilities have been set up for preparatory sand blasting and cleaning of metal surfaces, preheating the objects, application of plastic coating by the fluid bed process and subsequent heating or curing, if necessary.

The shop is equipped to apply such materials as chlorinated polyether, polyethylene, polyvinylchloride, epoxies, cellulose or nylon on valve bodies, pump parts, fan blades, magnetic flow tubes, and many other components of irregular or regular shapes. The finish is smooth, hard, uniform and homogeneous.

Vice-President Named at Pfaudler

C. W. Beck, general manager of *The Pfaudler Co.*, a division of *Pfaudler Permutit Co.*, was elected to the position of vice-president at a meeting of the company board of directors.

C. W. Beck

A mechanical engineering graduate of Swarthmore College, Beck came to the company in 1955 after 13 years experience with a manufacturer of processing equipment, where he rose to executive vice-president. Starting in market research, he became manager of the dairy food and machinery department in September 1956. He was promoted to assistant general manager in November 1957, and to general manager January 1, 1959.

Personnel Changes Announced by Geigy Industrial Chemicals

Geigy Industrial Chemicals announces the advancement of *John J. Paredes* to the position of Midwest

regional sales manager with headquarters in Chicago. He joined the firm in January 1959 and, until recently, has been field sales representative operating out of St. Louis. He was associated previously with the Monsanto Chem. Co., where he was engaged as sales supervisor for the Organic Chemical Division's Special Chemicals Department and as a member of the advertising and sales promotion staff.

Mr. Paredes is a graduate of Boston College where he received his A.B. degree in Chemistry in 1950. He served as First Lieutenant in the U. S. Army Chemical Corps. from which he was honorably discharged in 1953.

Richard J. Michelini has joined the Chicago sales force. He was associated previously with Armour Chemicals in applications research and as a member of the sales promotion staff, then with The Virginia Smelting Co. as a field representative for the Chicago area.

Mr. Michelini is a graduate of Colorado State University where he received his B.S. degree in Bacteriology. He served as a First Lieutenant in the U.S. Army Artillery from which he was honorably discharged in 1955.

Ground Broken for New Electronics Division Formed by Palumbo Bros.

Ground has been broken in Linden, New Jersey, for the erection of a specially designed building to house the new electronics division formed by *Palumbo Bros., Inc.*, one of the largest electroplating facilities in the East, established in Newark, N. J., since 1915. To be known as Platronics, the new division will reportedly specialize in specification electroplating of electronic components with all the precious, as well as base metals.

The Honorable William J. Hurst, Mayor of Linden, N. J., accepts gold plated shovel from John Palumbo, secretary and general manager of Platronics, preparatory to breaking ground for the new plant.

The building will encompass over 20,000 square feet of custom-made equipment to provide the close tolerance plating demanded by the electronics industry, particularly with precious metals. Facilities will reportedly include specially designed equipment for preplate processing of Kovar transistors and other semiconductor products, zincate activators for aluminum components (as used in certain classified missile and rocket applications) to assure adhesion of specified precious metal electroplates, several full automatic and semi-automatic plating machines for quick processing of large, mass production runs.

Officers of the new corporation are: *A. J. Palumbo*, president; *A. F. Palumbo*, vice-president; *A. C. Palumbo*, treasurer; and *John Palumbo*, secretary and general manager. The company will be temporarily situated at 347 Ferry Street, Newark, N. J., until the new facility is completed sometime in the early fall.

Cooper Alloy Corp. Appoints DePiano

Cooper Alloy Corp., Hillside, N. J., has announced the appointment of *Michael DePiano* to the position of sales manager, Valve and Fitting Division. He succeeds *Clayton L. Heintz*,

who has established a sales agency, and will represent the division in the Philadelphia area.

Mr. DePiano joined the company in 1950, as a design engineer. In 1955 he was appointed sales representative for valves, fittings and castings in the New York area. Previously he was, from 1947-50, a design engineer with the Worthington Pump Corp.

Ultrasonic Industries Inc. Forms Canadian Subsidiary

Ultrasonic Industries, Inc. of Albertson, N. Y., has announced the formation of a Canadian subsidiary, *Ultrasonic Industries (Canada) Ltd.*, 1512 Eglinton Ave., West, Toronto, Ontario, the first of several such companies contemplated by UI in the development of international markets for its ultrasonic cleaning equipment and other ultrasonic devices.

UI (Canada) is the first company exclusively devoted to ultrasonics to be incorporated in Canada. Initially, the Toronto based company will direct the marketing, distribution and service activities for its parent U. S. company in Canada's rapidly expanding technical economy. The new organization will act as sole sales agent, coordinating the affairs of distributors throughout the Dominion. Inventories of all ultrasonic cleaners and cleaning chemicals, as well as service and repair facilities, will be maintained at the Toronto warehouse. Prompt deliveries, twenty-four hour service and close customer liaison will be offered by these new facilities.

Julian Conway, one of the outstanding personalities in the Canadian electronics industry, has been elected president of the new company. Other officers and directors are as follows: *Paul M. Platzman*, chairman of the board; *Herbert A. Frankel*, vice-president and director; *Barbara A. Jewett*, secretary-treasurer and director, and *Harold S. Remz*, director.

Assisting Mr. Conway will be *Warren M. Givins*, distributor sales manager and *Dick Richards*, industrial sales manager.

New Chemical Specialties Plant Put Into Production by Pennsalt

Production and distribution of a diversified line of chemical specialties products has begun by *Pennsalt Chemicals Corp.* at a new 34,000 square-foot plant just completed in Atlanta, Ga.

Located on a ten-acre tract in College Park adjacent to the new expressway on the southern perimeter of Atlanta, the new plant includes both interior and exterior materials storage and manufacturing facilities. The

Earle C. Call

ment considerable experience as a consulting engineer. For 12 years he was a manufacturer's representative in New York State for industrial heating, metal cleaning and finishing equipment, as well as electronic control systems and paint finishing systems.

Call is a graduate of Purdue University where he took his electrical engineering degree in 1932.

Bee Chemical Moves to New Plant

Bee Chemical Co., formerly of Chicago, has announced its move to a newly completed, modern plant erected by the company on a 14-acre site at 2700 East 170th Street in Lansing, Ill., a suburb of Chicago. The 28,000 sq. ft. building houses the administrative and sales offices as well as research and manufacturing facilities. These had previously been at separate locations.

A tank farm is being completed adjoining the new plant for large volume bulk handling of solvents and other intermediates used by the company in their manufacturing processes.

The site of the new plant, immediately off the Kingery Expressway South of Chicago, was selected for customer convenience and proximity to truck transportation.

Culligan Appoints Danek as Commercial and Industrial Manager

Leonard R. Danek has been appointed manager of the commercial and industrial water conditioning equipment department of *Culligan, Inc.*, Northbrook, Ill., international manufacturer of water treatment equipment.

plant is near every type of transportation for fast movement of goods and personnel. It is located on the Central of Georgia Railroad, is near the Atlanta Airport, and has access to the new expressway within a quarter mile. In addition, the new plant is located in a booming industrial park.

Area manager, responsible for all phases of the new plant's operation, is *Robert F. Ragsdale*, who has held production and administrative positions in both the Industrial Chemicals and Chemical Specialties Divisions. He was previously area production manager for the Chicago Heights, Ill. and Delaware, Ohio plants. He joined the company at its Calvert City, Ky. Works when it was constructed in 1949 and served as office manager and accounting supervisor there before being transferred to the Specialties Division in 1954.

Larry J. Browder, who has served as a special project supervisor and process foreman at the Cornwells Heights, Pa. chemical specialties plant, has been appointed plant supervisor of the new plant.

Ransohoff Co. Appoints Representative

Ransohoff Co., Hamilton, Ohio has announced the appointment of *Earle C. Call & Associates* as sales engineering representative in the San Francisco area.

Mr. Call brings to his new appoint-

Leonard P. Danek

Mr. Danek was previously regional sales and advertising mgr. of Industrial Filter & Pump Mfg. Co. of Cicero, Ill. and, prior to that, was research engineer with Swift & Co. He is a graduate of the Illinois Institute of Technology and is active in the American Institute of Chemical Engineers.

Rozensky Joins Pennsalt Chemicals

Albert Rozensky has joined the Corrosion Engineering Products Dept. staff of *Pennsalt Chemicals Corp.* as technical service engineer. He will have his headquarters in Natrona, Pa., site of the firm's manufacturing, research, and sales headquarters.

Before joining the company, Rozensky had extensive experience in chemicals and coatings research and production. Most recently, he was senior chemist for Thompson & Co., of Oakmont, Pa. for three years. He was formerly a resin chemist for the same firm. His other experience in the coatings field includes that of production superintendent for Steen Varnish Co., a division of Sears Roebuck & Co., and coating engineer for Union Tank Car Co.

Rozensky holds a B.S. degree from the University of Pittsburgh. During World War II he served four years in the Pacific Theater as an Aviation Ordnance specialist with the U. S. Navy. He is a member of the Paint, Varnish & Lacquer Association.

Hampden Chemical & Equipment Co. Formed

Recently, *Hampden Chemical & Equipment Co.*, a wholly-owned subsidiary of Hampden Color & Chem. Co., Springfield, Mass., formally opened its doors at Juniata and Richmond Sts., Philadelphia, Pa.

Representatives of the company will include: *Richard G. Woolworth*, chairman of the board; *John E. Costigan*, president; *Kenneth W. Clayton*, vice-president; *Theodore Cox*, secretary; *Mrs. Hazel D. Baker*, treasurer; *Otto R. Kuhn*, purchasing engineer; and *Callan England*, a member of Hampden's board and a vice-president of the First Penna. Banking & Trust Co.

The company will sell a complete line of chemicals, processes, and equipment to the metal finishing trade as well as handle heavy chemicals for general distribution in Pennsylvania, Delaware, Maryland and New Jersey.

Roth Joins Weston

Ernest R. Roth, formerly in charge of Atlantic Refining Co.'s Industrial Wastes Engineering Section, has been placed in charge of the air pollution activities of the Research Development and Consulting Division of *Roy F. Weston, Inc.*, specialists in industrial water pollution control, sewage treatment, air pollution control and water supply. He will be located in the Newtown Square, Pa. office.

Mr. Roth is a registered professional engineer and is a member of the Research Committee of the Water Pollution Control Federation, the Air Pollution Control Association, American Chemical Society, American Petroleum

Sept. 16: 2nd Metropolitan Regional Technical Session, Newark Branch A.E.S. Host, Robert Treat Hotel, Newark, N. J.

Sept. 17: 24th Annual Educational Meeting and Banquet, A.E.S., Hotel Statler, Boston, Mass.

Oct. 9-13: Fall Meeting, The Electrochemical Society, Shamrock Hotel, Houston, Texas.

Oct. 12-14: 7th National Symposium, American Vacuum Society, Cleveland-Sheraton Hotel, Cleveland, Ohio.

Oct. 17-21: 42nd National Metal Exposition and Congress, A.S.M., Trade and Convention Center, Philadelphia, Pa.

Oct. 27-29: 73rd Annual Meeting, National Paint, Varnish and Lacquer Association, Drake Hotel, Chicago, Ill.

Oct. 29: 2nd Annual Midwest Regional Conference, University of Notre Dame, So. Bend, Ind.

Oct. 31-Nov. 2: 38th Annual Meeting, Federation of Societies for Paint Technology, Hotel Sherman, Chicago, Ill.

Nov. 8-11: First National Exposition and Congress, Society of Die Cast Engineers, Detroit Artillery Armory, Detroit, Mich.

Jan. 17-18: Annual Meeting and Conference, Society of Vacuum Coaters, Lake Towers Motel, Chicago, Ill.

Feb. 3-4: 3rd Annual Dixie Regional Technical Session, A.E.S., Blue Ridge Host Branch, Hotel Roanoke, Roanoke, Va.

Feb. 4: 7th Annual Tri-State Regional Meeting, A.E.S., Deshler-Hilton Hotel, Columbus, Ohio.

Feb. 11: 8th Interim Meeting, Supreme Society, A.E.S., New England Regional Council, Host, Statler Hotel, Hartford, Conn.

Ernest R. Roth

Institute, Pennsylvania Sewage and Industrial Wastes Association, American Institute of Chemical Engineers, and the Water Resources Association of the Delaware River Basin.

Binks Spray School to Run in September Through December

The tuition-free spray painting school operated by *Binks Mfg. Co.*, Dept. MF, 3114 Carrol Ave., Chicago, Ill., has set the following class dates for the 1960 Fall and Winter session:

September 12-16
October 3-7
November 7-11
December 5-9

Conducted by *Jack Adams*, director of customer research, the school will cover all aspects of spray painting, including the latest developments in spray equipment systems and automatic spray controls. Airless and electrostatic spray painting will be given special attention, as well as recent developments in the field of multiple-component material spray application.

The school will be open upon application to all industry, with no tuition fee attached. Classes will be limited to approximately 25 persons, for optimum teaching conditions. Each class session will last five days.

Recently remodeled and refurnished, the classroom is also equipped with the latest in instructional aids, including spray booths and guns, cut-away components, drawings, schematics, and other audio-visual material. Students will be given ample opportunity to work with spray equipment first-hand.

Westinghouse Appoints Ultrasonic Cleaning Distributor

C. Burwell, Inc. of 654 Allwood Road, Clifton, N. J. has been appointed exclusive distributor in New Jersey, New York City and Long Island for Westinghouse ultrasonic cleaning equipment.

The New Jersey firm, headed by President *Chester Burwell*, is a distributor of industrial cutting and machine tool supplies.

Grube Appointed Manager at Metals & Controls

Clifford J. Grube has been appointed manager of field sales for *Texas Instruments Inc.*, Metals & Controls Division. He joined the firm in 1944 as a sales engineer for the company's

Clifford J. Grube

Spencer Products group, and was named New York district manager for gold filled and related products by the firm's General Plate Products group in 1956. In 1959 he was appointed Eastern regional manager for the division.

Before coming to TI, he was a sales engineer with Mercoid Corp. and an application engineer for General Electric Co.

American Nickeloid Co. Relocates N. Y. Office

After a tenure of 30 years in downtown Manhattan, the New York office of *American Nickeloid Co.*, manufacturers of pre-plated metals, has been moved to Garden City, N. Y. The firm's new address is 1001 Franklin Ave., and the telephone number PIoneer 1-3010.

In charge of the sales office in its new location will be *J. K. Storkman*,

who has been associated with the firm 19 years, the last ten of these as a member of the sales staff in the New York office. He was appointed as manager of the office in March.

Heil Process Equipment Corp. Appoints Peters Manager of Rigidon Plant

Robert I. Peters has been named manager of the Rigidon plant of *Heil Process Equipment Corp.* of Cleveland, Ohio. He will be in charge of all manufacturing, estimating, and product promotion of the company's reinforced plastic corrosion resistant process equipment.

Peters joined the company in 1946 as an estimator, later became a sales

Robert I. Peters

engineer, Western Division sales manager, and more recently was assistant chief engineer. He is a graduate of Fenn College in Mechanical Engineering, a member of the Cleveland Engineering Society and several other technical groups, and is a past president of the Cleveland Branch of the A.E.S.

Platronics Appoints Kankowski Sales Engineer

Eugene J. Kankowski, most recently production control manager for L. L. Constantin, has been appointed sales engineer, Platronics Division, *Palumbo Bros., Inc.*, industrial electroplating in Newark, N. J., since 1915. According to the announcement, Mr. Kankowski will utilize his wide acquaintance in the electronics industry to promote the close tolerance plating service, particularly with precious metals, which the company was recently formed to provide.

Eugene J. Kankowski

Mr. Kankowski, who attended Newark College of Engineering, also holds a B.S. degree in accounting from Seton Hall University. Prior to his position with L. L. Constantin, he was associated with the U. S. branch of McCulloch Co. of Canada, Ltd., for five years, as production and material control manager, and with C-O-Two Fire Equip. Co. for four years, as assistant production control manager.

Diamond Alkali Announces Promotions

Diamond Alkali Co. has announced the election of *J. A. Hughes* and *W. H. McConnell* to the positions of senior vice presidents. Hughes has held the position of vice-president-administration and secretary, and McConnell, vice-president—marketing. Both men are members of the board of directors and, in addition to continuing their present activities, they will assume broader management responsibilities.

Also announced were several new management appointments, which will provide better utilization of management talents in a progressive organization structure.

J. W. Mantz, general manager — Soda Products Division, has been appointed director of trade development, a new position.

A. B. Tillman, general manager ← Electro Chemicals Division, was named general manager — Soda Products — Chrome Division, a combination of the Soda Products and Chromium Chemicals Divisions.

F. W. Jarvis, general manager — Chromium Chemicals Division, was appointed general manager — Electro Chemicals Division.

Lynch Assumes New Duties at Wyandotte Chemicals

Wyandotte Chemicals' J. B. Ford Division announces the appointment of *Edward J. Lynch* as sales manager of its Minneapolis district. He began his sales career with the firm in 1948, and was a field sales manager of the division's Cincinnati district prior to his latest assignment. His broad knowledge of the company's cleaning products, coupled with administrative experience, will be particularly valuable in his new duties, say company spokesmen.

Edward J. Lynch

Quarton on Lab Staff of Lea Mfg.

Evan F. R. Quarton has been appointed assistant chemist on the laboratory staff of *The Lea Mfg. Co.*, Waterbury, Conn. He is a graduate of the University of Massachusetts and a member of the American Institute of Chemical Engineers.

Evan F. R. Quarton

Previous connections included duty as an aerographer in the U. S. Navy, and the position of chemical plant inspector with the Factory Insurance Association.

French Named Manager of Development for Pennsalt

John M. French has joined *Pennsalt Chemicals Corp.* as manager of development for the company's Corrosion Engineering Products Department. With headquarters in Natrona, Pa., he will be responsible for the research and development for new products in the firm's extensive line of corrosion resistant mortars, and protective coatings and plastics for the construction and maintenance of structures industries.

French, who holds a B.S. degree with honors in chemistry from Duke University and an M.S. in chemical engineering from Columbia University, has been engaged in chemical research and technical service since 1941. For the past 12 years he was engaged

in research and technical service for E. I. duPont de Nemours & Co. at various locations. His experience also includes chemical research with American Viscose Corp. and the Naval Research Laboratory at Anacostia Station, D. C.

He is a member of the American Chemical Society, American Association for the Advancement of Science, Alpha Chi Sigma, Phi Lambda Upsilon, and Phi Beta Kappa.

DeVilbiss Metal Fabricators now Division of DeVilbiss Co.

Announcement has been made by *The DeVilbiss Co.*, Toledo, that its wholly-owned subsidiary, *DeVilbiss Metal Fabricators Co.*, will henceforth become an operating division under the name, *The DeVilbiss Co., Metal Fabricators Division.*

The subsidiary company was dissolved and liquidated under Section 332 of the Internal Revenue Code of 1954.

Operations will continue unchanged at 5741 Russell St., Detroit. *T. Kenneth McGuire*, vice-president of DeVilbiss, is in charge of the operations of the division.

Oakite Assigns Three to Field Organization

Oakite Products, Inc. has announced the assignment of three representatives to the company's technical field service staff.

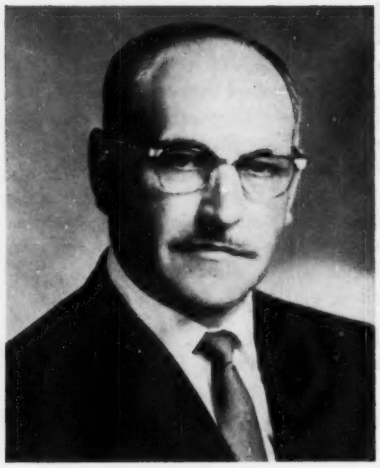
Lon E. Welch, formerly a representative in Akron, Ohio, has been transferred to Kokomo, Ind., where he replaces *Daniel B. Lamb*, recently appointed manager of the company's Detroit division. *George E. Park*, a graduate of the University of Arkansas, has been named to the Springfield, Mo. territory, and *James D. Enstad*, a graduate of the University of Minnesota, has been appointed representative in St. Paul. Mr. Enstad and Mr. Park

Lon E. Welch

George E. Park

James D. Enstad

Melville Morris



F. C. Bissell

recently completed an intensive eight-week training program at the firm's New York laboratories and in the field.

Chicago Rubber Expanding Facilities

The expansion of manufacturing facilities that will include a modern research laboratory and technical center is nearing completion at *Chicago Rubber Co., Inc.*, 651 Market St., Waukegan, Ill.

Morris With Public Relations Firm

Melville Morris, founder of Circo Equipment Corp. and other cleaner firms, is now vice president of *Black-Russell-Morris*, an advertising agency in Newark, N. J., which specializes in the industrial field.

Bissell Joins Riegel Bias Buff

Bias Buff & Wheel Division, *Riegel Textile Corp.* has announced the appointment of *F. C. (Si) Bissell* as their representative in the Grand Rapids — Saginaw Valley area. He will report to *B. R. Boyd* in the Detroit office, 4346 N. Woodward Ave., Royal Oak, Mich.

Mr. Bissell joins the company with more than 30 years experience in the polishing and buffing field, including three years in his own business. For 25 years he was with Doehler Jarvis Division of National Lead, Grand Rapids Plant, the last 12 years as finishing superintendent.

New Name for L. R. Kerns Co.

On recommendation of the board of directors, the stockholders of the *L. R. Kerns Co.* have voted to change the corporate name to *Kerns United Corp.*

In view of the company's extensive expansion program, which includes increased national and international sales coverage, product diversification, and additional manufacturing facilities, it was felt that the new name

would be more descriptive of the entire operation.

Polymer Corp. Breaks Ground for Chicago Plant

Ground has been broken for a new *Polymer Corp.* plant in Northwestern Industrial Park, Rolling Meadows, Chicago. The principal operations at the facility will be plastic coating of metal products with the new Whirlclad coating system and demonstration of the technique to prospective licensees who desire to coat by the patented process in their own plants. The structure will also be used as a warehouse for industrial plastic stock shapes.

Van Straaten Transfers Kessler

Joseph E. Kessler, head of the Pittsburgh sales region, has been named technical sales director of the *Van Straaten Chemical Co.,* Chicago. Kessler, who was in charge of the sales training program, will move to Chicago headquarters of the metal working compounds company.

Kessler has a M.B.A. in sales promotion and market research from Harvard University as well as a B.S. in mechanical engineering from Villanova University. He served at sea in the navy and also as liaison officer with Sears Roebuck & Company in a joint navy-industry program. Before joining Van Straaten in 1953, Kessler was assistant sales manager, fabricated parts, for the Camden, N. J. region of Reynolds Metal Co.

Union Carbide Plastics Appoints A. J. Lynch

Union Carbide Plastics Co. has appointed *A. J. Lynch & Co.* as a distributor in the protective and decorative coatings fields in Southern California and Arizona.

R. A. Mack, president of the firm, is one of the best known figures in the coatings industry on the West Coast. The company maintains office and warehousing facilities at 4560 E. 50th St., Los Angeles.

M & T Enlarges Lab Facilities

Establishment of new and enlarged laboratory facilities for electroplating analytical and technical services has been announced by *Metal & Thermit Corp. Ronald Dow,* manager of the Plating Technical Service Department, is now responsible for both customer

service and the new technical service and analytical laboratories. *Peter G. Kenedi,* formerly with the company's research laboratories at Rahway, N. J., is laboratory supervisor.

The extensive electroplating laboratories house such new equipment as a recording spectrophotometer, colorimeter, photomicroscope (up to 1200 X magnification), micro-metallograph, electronic thickness gauge, micro-hardness tester, and fatigue tester. In addition, the laboratory is equipped with fume hoods, special heating ovens, three thermo-regulated water baths, automatic titrating equipment, and other apparatus necessary to provide complete service facilities.

McKesson & Robbins Opens New Branch

A new chemical branch in Duluth, Minn., was opened recently by the chemical department, *McKesson & Robbins, Inc.* Sales office and warehouse facilities are located at 824-832 W. Railroad St. The branch will operate as a unit of the Minneapolis Chemical District and will serve the needs of industrial chemical custom-

ers in northeast Minnesota and northwest Michigan.

Richard A. Wagner, formerly a salesman with the company's Minneapolis branch, will manage the Duluth unit's chemical distribution operations.

Pennsalt Names Woolley Manager of New Region

Pennsalt Chemicals Corp. has named *Douglas F. Woolley, Jr.* manager of the newly-created Eastern Seaboard Region for the Corrosion Engineering Products Department. Woolley, who has been a sales representative for the firm for more than three years, will have his headquarters in Philadelphia.

A graduate of Johns Hopkins University with a B.S. degree in Business Administration, Woolley joined the company as a market analyst in 1952. In 1955 he was assigned to the Technical Service Department of the Chemical Specialties Division. He joined the Corrosion Engineering Products Department staff two years later.

He is vice-president of the Philadelphia Section, National Association of Corrosion Engineers. Last year he served as treasurer of the section.

Manufacturers' Literature

Electroplating Filters

Udylite Corp., Dept. MF, 1651 E. Grand Blvd., Detroit 11, Mich.

Technical data on eight standard side cleaning models of the U/D Series "60" filters are offered in this descriptive brochure. The well-illustrated brochure also contains a specification table on all models.

Immersible Transducers

National Ultrasonic Corp., Dept. MF, 111 Montgomery Ave., Irvington 11, N. J.

A catalog sheet describes the bulkhead type and end fitting type immersible transducers offered.

The two-color catalog sheet includes photos, applications, features, description, sizes of transducers available, their dimensions, input power and respective crystal radiating surfaces. A table also is included which shows the numbers of each type and sizes of transducers which can be used with various models of generators.

There is also a section devoted to junction boxes and accessories.

Dip Coating for Brass

Bee Chem. Co., Dept. MF, 2700 E. 170th St., Lansing, Ill.

Bulletin M-800 describes a new water soluble, water thinnable, and nonflammable dip coating for the protection of brass and brass plated steel products. The bulletin gives product and application information and test results data.

Metal Finishing Guide

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

This new 4-page guide contains condensed information on materials for such finishing operations as buffing, polishing, burring, satin finishing, buffing wheel set-ups and wheel cements. There is also a section on additives and specialties for bright plating processes for gold, silver, copper, nickel, cadmium, brass and zinc plating.

Felt Application Guide

American Felt Co., Dept. MF, Glenville, Conn.

A new 8 page illustrated booklet describes some of the varied uses of the 800 types of specifically-designed "A-Plus" felts manufactured for industrial and decorative uses.

Soak Cleaners

Frederick Gumm Chem. Co., Dept. MF, 538 Forest St., Kearny, N. J.

Technical bulletin No. 360 describes a number of the Clepo soak cleaners. The eight cleaners discussed, both granular dustless compounds and liquid cleaners, represent general fields of use and indicate the range of the line. Included are applications and features of the specific cleaners, recommended cleaning time and temperature at which each is used.

Mixed-Bed Deionizers

Elgin Softener Corp., Dept. MF, 136 N. Grove Ave., Elgin, Ill.

Ultra-DeIonizers of mixed-bed design are described in Bulletin 512A and its accompanying technical data.

pH Meter

Sel-Rex Instruments, Inc., Dept. MF, Nutley, N. J.

Technical data sheet on the Electrion, a palm-sized pH meter, features illustrations showing the meter in operation, component parts with their uses, and the unique handle and electrode holder.

Infrared Heating

Fostoria Corp., Infrared Div., Dept. MF, Fostoria, Ohio.

Technical Bulletin 59-220, 8 pages, objectively discusses infrared source theories and laws, prediction of quantity and quality of radiation from heated sources, color blindness, and other technical points.

Organic Coating Selector

Bee Chemical Co., Dept. MF, 12933 S. Stony Island Ave., Chicago 33, Ill.

"Coatings Selector," is a guide to the selection of specialty coatings available for application on plastics, metals, glass and wood. The charts, which can be mounted for ready reference, show the uses and characteristics of the company's spray, dip and flow coating materials, vacuum metalizing coatings, and standard plastisol formulations.

Stainless Steel Pump

Sonic Engineering Corp., Dept. MF, 146 Selleck St., Stamford, Conn.

A new bulletin describes a high pressure, stainless steel pump, which will handle most processing liquids and is available in two capacities ranging from 1 to 30 g.p.m., with pressures up to 400 p.s.i.

Construction is described in detail and an exploded view of the pump is shown with identification of parts.

Pipeline Strainers

Sarco Co., Inc., Dept. MF, 635 Madison Ave., New York 22, N. Y.

Four basic types of pipeline strainers for condensate, steam, water, oil, air, gas, and other piped fluids are covered in Bulletin No. 1210. This 4-page bulletin details construction and operating features of a range of y-type strainers designed to protect steam traps, pumps, control valves, com-

pressors, and other equipment against dirt, scale, or metal chips in pipelines. A highlight of the bulletin is the brand new Type "CT" cast steel strainer for pressures to 600 p.s.i.

Plating Services

Burton Silverplating Co., Dept. MF, 11240 Playa, Culver City, Cal.

A new, pictorial, facilities brochure outlines in full the services, facilities and personnel of the above firm, and sketches the history of the company's growth in gold, rhodium, silver and platinum plating.

Refrigerated Tumbling Barrels

Tumb-L-Matic, Inc., Dept. MF, St. Mary's St., Stamford, Conn.

A new catalog sheet, LT-60 describes a line of CO_2 refrigerated tumbling barrels for deflashing soft rubber parts without dry ice.

The literature offers complete specifications on the standard machines plus information regarding optional features. Data regarding the cost reductions in handling and storage obtainable through the elimination of the dry ice method are also included.

NEWS FROM CALIFORNIA

Venderlator, Inc., Fresno, Calif., manufacturer of soft drink vending machines, has consolidated its two plating plants in the Fresno area into one shop in Palmdale, eleven miles north of the city.

The Fresno plant at present is being used for building missile containers. It will be deactivated by the end of the year when all manufacturing and plating will be done in Pinedale. The Pinedale facility is equipped for anodizing, conversion coating, and cadmium plating of steel parts for the vending machines. Nickel-chrome work on vending machine trim parts is jobbed out.

Struckhoff Engineering & Sales Co. was established by *Herman Struckhoff*, effective June 1, and is operating at 1228 S. Atlantic Blvd., Los Angeles, as a distributor of metal finishing supplies and equipment, under the firm name of Sesco.

Before coming to California, Struckhoff was with Lasalco, Inc., in St. Louis, Mo., for 25 years, and served as president for five years. After coming to Los Angeles in November, 1955, he formed Laco, Inc., Los Angeles, and was its president, until the recent dissolution of the firm and the organization of Sesco. Struckhoff is a past-president of the Metal Finishing Suppliers' Association. He was the MFSA liaison man for the AES convention in Los Angeles.

Training Program A, the first of a three-part course in electroplating and plating chemistry sponsored by *Milton Weiner*, Southern California chemical engineer, is scheduled to start September 19 at the Weiner Laboratories, 12631 Imperial Highway, Santa Fe Springs, Calif., a Los Angeles suburb.

Classes will be held every Monday

night from 7:15 to 9:45 o'clock for 12 weeks beginning September 19. Each student will receive a free copy of the METAL FINISHING GUIDEBOOK DIRECTORY issued by the publishers of METAL FINISHING magazine.

Program A will be devoted to practical electroplating and metal finishing subjects. Training Program B, on chemistry and electrochemistry, will run for 12 weeks beginning January 9, 1961; and Program C for 12 weeks beginning March 28, 1961.

Kenneth S. Repp, formerly a partner in Laco, Inc., Los Angeles, recently established Reppco Engineering & Sales with office and warehouse facilities at 6556 Whitier Blvd., Los Angeles. He operates as a distributor of metal finishing processes and equipment. *L. J. "Whitey" Lundt* has joined the staff as a sales engineer.

Marion Sobergren has joined products Engineering Service in Pasadena, Calif., as plating foreman. He formerly served as assistant plating foreman for Rocketdyne, Inc., Canoga Park, Calif. The Pasadena firm specializes in printed circuit work and is equipped for gold, silver, rhodium, and bright nickel plating.

The Los Angeles Society for Coatings Technology elected new officers at its June 8 meeting in the Montebello Country Club, Montebello, Calif. The new officers are: *Fred E. Oberlin*, president; *Allan U. Hershey*, vice-president; *Charles Mooney*, treasurer; and *Walter Barber*, secretary.

This was also past-presidents' night, and fourteen former presidents of the society were introduced. The speaker was *Bernard W. J. Pearce* of the Southwestern Engineering Co. His subject was "Particle Size Reduction by High Frequency Vibration," which included a discussion of the vibro-energy mill developed in England in 1957. Mr. Pearce described the mill as a unit that grinds as well as disperses, and said that it represents the first new major advance in grinding since the ball mill.

Among new equipment recently installed by Hemphill Spring Co. of Los Angeles is a new type tumble action blasting unit for cleaning, deburring and shot-peening springs. The machine is designed to process medium and small parts of a variety of shapes that are difficult to handle economically with conventional equipment.

Finished springs are blasted for two purposes: with abrasive grit to remove small amounts of metal; or with steel shot to improve fatigue characteristics of manufactured parts. The parts are loaded into a removable hexagonal barrel. With the lid closed, the barrel is kept in constant rotation, exposing all sides of the part to the blast stream.

Western Scientific Instrument Co., Inc. of Redwood City, Calif. has established a new technical coordinating district in San Diego, bringing to nine such districts in the major industrial and scientific areas of the state. *Ralph P. Corbett*, a San Diego electronics and communications engineer, has been named supervisor in charge of activity in San Diego.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Newark Branch

President *John Banta* called the meeting to order at 8:30 P.M. About fifty members and guests were in attendance which was quite good, as it was a very hot, humid evening. The reading of the minutes of the previous meeting were dispensed with.

No new applications were received. The following were elected to membership: Messrs. *P. Augusta* of Micro Metals, Inc.; *A. H. Craft* of Sel-Rex Corp.; *C. Jarema, Sr.* of C. Jarema Co., Inc.; *W. H. Mysch* of Barsam Plating Co.; *R. Wighton* of Bell Telephone Labs.; *W. R. Wilczek* of Vibro Mfg. and Eng. Co.

Cy LaManna was then called upon to give a resume of next year's program and the status of the Electroplating Course. He stated that the program was arranged pending confirmation from the speakers. The course will be resumed in the fall provided that someone will take over Cy's work and if there is sufficient demand. Interested people should contact him at Allied Allegri, Inc. in Nutley, N. J.

Secretary *Don Foulke* reported that *Dave Clarin*, who was quite ill, is back on the job. His many friends in the Branch were quite happy to hear the good news. We also heard from *Jim Conolly* who is working on an Air Force base in Alaska.

A motion was made and passed to have a more suitable plaque made for the *Lou Donroe Award*. The president appointed a committee consisting of Messrs. LaManna, Meyer and Abazia to have this job done in time for the September meeting.

The meeting was turned over to Mr. LaManna for the main activity of the evening, namely, a question and answer period. The panel of experts consisted of Messrs. Ehrhardt, Foulke, Korbelak, Kosmos, and Lowenheim. As *Mario DiChiara* was in good form, being both serious and humorous, he was asked to join the panelists. After approximately seventy minutes, the members adjourned to partake of beer, cheese and crackers while the discussions continued until midnight.

Gustav Bittrich,
Assistant Secretary

Los Angeles Branch

A panel discussion on anodizing was presented as the educational feature of the June 8 meeting. The discussion dealt with all phases of anodizing, starting with production and fabrication of aluminum sections and continuing through pre-treatment and finally to hard or standard anodizing techniques.

Don E. Baudrand, chairman of the educational session, presented three outstanding West Coast authorities on anodizing to serve on the panel. They were: *Raymond W. Karczynski*, materials and process engineer for the Long Beach division of Douglas Aircraft Co.; *Joseph E. Trankla*, assistant general manager of Anadite, Inc., South Gate, Calif.; and *William I. Rogers*, metallurgist for Harvey Aluminum Co., Inc., Torrance, Calif.

Karczynski discussed recent developments in color anodizing, and spoke from 35 years experience in the metal finishing business. Trankla discussed hard anodizing; Rogers' talk dealt with the metallurgy of aluminum extrusions, touching on surface, mill finishes, corrosion, and other subjects.

Don H. Ross, as moderator, directed a 45 minute question-and-answer period after each of the three panelists had given a 12 minute talk on an assigned phase of anodizing.

Branch President *Frank Virgil* presided over the business session, at which 80 members and eleven guests were present. *Truman Stoner*, Los Angeles' representative on the 13-man national membership committee, reported on the committee's plans to stimulate A.E.S. membership.

The last reports of the convention and handbook committees were given at this meeting. *George Hetz*, co-chairman of the national convention committee, gave a round-up report on last minute plans.

Eleven guests were introduced by Sergeant-at-arms *Oscar Grisat*. Among the guests was attractive *Miss Emily Peach*, owner of Metalectro Laboratory in North Hollywood, which specializes in electroless nickel work. Other guests included *John McNail, Robert Shaney, Neil Lawrence, John Larson, Neil Bent, E. L. Millon, Arthur Sheppard, Marion Sobergren*. Seven new members were initiated and the application of one other referred to the board of managers for processing.

Chicago Branch

The members of the Branch met for the last session of the 1959-60 season on Friday, June 10, at Petricca's Restaurant and Lounge, 510 N. Western Ave. This site was selected on a trial

basis for future meetings of the Branch.

Charles Geldzahler received a "Pin" for serving as president of the Branch during the 1959-60 term. Ten applications were turned over to the board of managers for approval. *Paul Glab* announced that plans are underway for the next Midwest Regional Session which is to be held on October 29, 1960, at the University of Notre Dame, South Bend, Ind. *Si Gary*, librarian, informed the members that his committee of eight decided to have three round-table discussions for the coming year. Meetings will be held on the second Friday of the month, the meeting place to be decided by the Board of Managers.

Mr. Gary introduced *John Carmichael*, of Branson Ultrasonic Corp., whose subject was "Ultrasonics as Applied to Electroplating." Mr. Carmichael, after a lively question and answer period, was given a rising vote of thanks for his very interesting and illustrated talk. This concludes the technical sessions for the 1959-60 season and there will be no business meetings during the months of July and August.

Christopher Marzano,
Publicity Chairman

Blue Ridge Branch

The members of the Branch attending the June 4 meeting enjoyed a picnic on the campus of Virginia Polytechnic Institute in Blacksburg, Va. Forty-one members, their families and guests were present. Everyone had a very enjoyable afternoon.

Dr. Nelson Murphy, research professor at the school, had tours arranged for both men and women. The women were taken on a tour of the Home Economics Department of the school. The men toured the Physics Department and saw the recently completed atomic reactor. After the tours everyone enjoyed a Southern Style barbecued chicken picnic.

The monthly meeting of the Branch has been recessed until September.

Donald H. McGee,
Secretary

OBITUARIES

A. P. MUNNING

August Peter Munning, vice-president of Munning & Munning, Inc., manufacturers of electroplating equipment and supplies, died on July 1st after a long illness.

Born in Chicago, Mr. Munning attended Chicago University and received both his bachelor of science and master of science degrees in chemical engineering at Massachusetts Institute of Technology.

In 1924, "Gus", as he was widely known, joined A. P. Munning & Co. in Matawan, N. J., a firm founded by his uncle. Two years later he went to Kobe, Japan, to establish a company plant and returned in 1929. In 1930 he joined his father, Peter, and brother, Jack, in establishing Munning & Munning, Inc. in Newark, N. J.

Mr. Munning was a member of The Electrochemical Society, the American Electroplaters' Society, the American Chemical Society, and he also played an important part in reorganizing the Metal Finishing Suppliers' Association. Gus served the MFSA as president in 1951-2, and was executive secretary from 1953 until his death.

Survivors are his wife, Mrs. Regina Hefferman Munning; two daughters, Mrs. John B. Noyes and Mrs. Cornelius Luehs; his parents, Mr. & Mrs. Peter P. Munning; a brother, John; a sister, Miss Pauline Munning; and eight grandchildren.

T. E. WALLINGTON

T. E. Wallington, of Wallington Plating Works, Richmond, British Columbia, died in the Vancouver General Hospital on Friday May 20th, 1960, at the age of 64. Up to the time of the accident which caused his death, he was actively engaged in running his plant, which he opened in Richmond, during March 1950. He was an active member of the B. C. Branch of the A.E.S., and served on the executive board as a director.

Mr. Wallington came to British Columbia from Eastern Canada about the late 1920's. After working at one of the local plating establishments he started up his own business, in Cambia Street, Vancouver, in 1935. Some of his early employees who learned their trade with him, today own their own shops in the area.

He will be sadly missed by his many friends and fellow members of the local Branch, as well as his business acquaintances throughout the Province.

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698	47.5	Elec. Prod.
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750/375	6/12	Excell-All
845	47.3	Elec. Prod.
940	32	Elec. Prod.
1000/500	6/12	Eager
1000/500	12/24	H-V-W
1500	15	Star
1500	30/50	Century
1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
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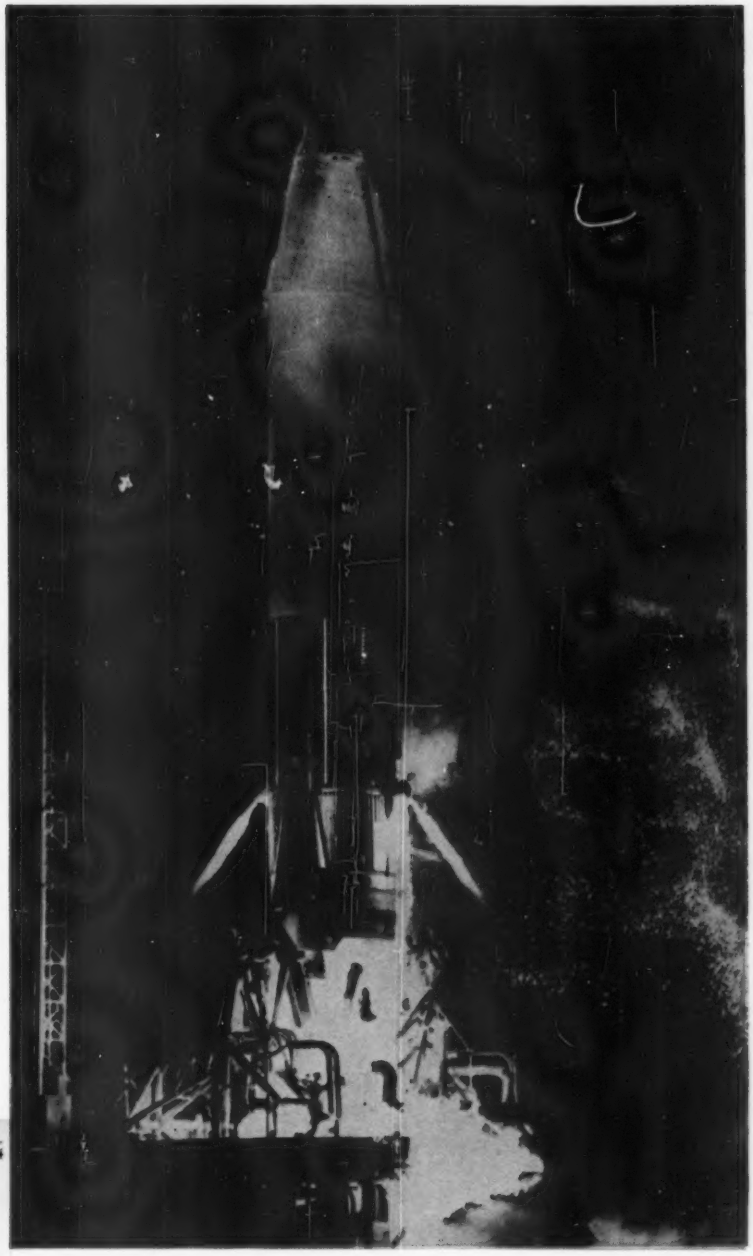

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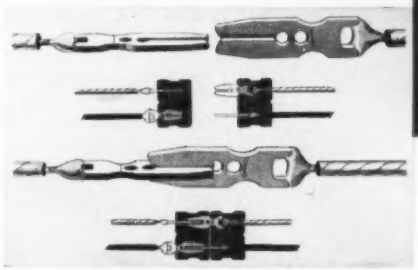

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